ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXVI. No. 4. CHICAGO, SATURDAY, JANUARY 23, 1915. ISSUED WEEKLY

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY, INC.

608 SOUTH DEARBORN STREET
CHICAGO

Charles W. Price, President and Treasurer.
A. A. Gray, General Manager. H. S. Tuthill, Business Manager.
C. W. Forbrich, Assistant Business Manager.

E. E. Wood . . . . . 13 Park Row, New York, N. Y.
Manager Eastern States.
J. B. McCarthy . . . . . Detroit, Mich.
Manager Middle States.
C. W. Forbrich . . . . . Chicago, Ill.
Manager Western States.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

Charles W. Price.....Editor-in-Chief
A. A. Gray.....Managing Editor
Morton Githens Lloyd.....Technical Editor
F. H. Bernhard.....Associate Editor
Howard Ehrlich.....Associate Editor

MEMBER SERVICE THE SOCIETY FOR ELECTRICAL DEVELOPMENT INC. SAFETY DO IT ELECTRICALLY

SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada.....4.00
One Year, Foreign Countries.....6.00
Single Copy, 10 cents. Back one month, each..25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
Street-Railway Service in Large Cities..... 141
Lap Windings..... 142
Economies of Electrification..... 143
Competition or Co-operation..... 143
Trying to Force the Metric System..... 143
DEPARTMENTS:
Commercial Practice..... 148
Electrical Construction..... 150
Dollar Wiring Kinks..... 155
Public Service Commissions..... 156
New Electrical and Mechanical Appliances..... 172
Latest Approved Fittings..... 176
Current Electrical News..... 177
Record of Electrical Patents..... 181
LEADING ARTICLES:
Electricity in Packing Plants..... 145
Electrical Engineering Problems.—By R. G. Hudson and W. V. Lyon..... 158
Export Trade and How to Get It.—III.—By G. F. Baggeféron..... 161
Two-Phase and Three-Phase Lap Windings in Unequal Groups.—By E. M. Tingley..... 166
LETTER TO THE EDITOR:
"Kelvin" for the Unit of Electric Energy.—By W. B. Wallis..... 171
MISCELLANEOUS:
Chicago Jovians Attend Beefsteak Dinner and Rejuvenation..... 144
Street-Railway Service Standards..... 144
Annual Meeting of the Illinois Electric Railway Association..... 144
Electricity in Rural Districts..... 148
Individual Drive in Textile Mills..... 149
Meeting of Brooklyn Section, National Electric Light Association..... 149
Bell-Ringing Transformers..... 150
Meter Loops for Pipe Service.—By Ernest Kinerim..... 151
Demonstrating a Rotating Field.—By Everett M. Russell. 151
An Accounting System for Contractors..... 152
Among the Contractors..... 152
Electrical Contractors' Association of Wisconsin..... 152
Illinois Contractors Hold Semi-Annual Convention..... 154
European Boiler-Room Practice..... 157
Western Red Cedar Men Meet..... 164
Annual Meeting of Western Society of Engineers..... 165
Promoting Service.—By John G. Montgomery..... 169
Suggestion Advanced for a National Electrical Week.... 170
The Engineering Foundation..... 170
Chicago Vehicle Meeting..... 171

Copyright, 1915, by Electrical Review Publishing Company, Inc.

STREET-RAILWAY SERVICE IN LARGE CITIES.

A multitude of problems arises from the growth of a community into the ranks of the large cities. One of the most difficult of these problems is the providing of safe, rapid and comfortable transportation for all passengers that wish to be conveyed from one section of the city to another at low cost. Many years ago it was discovered that street railways provided this type of transportation at minimum expense, and with the electrification of these lines great extensions and increases in carrying capacity have been made possible. Increase in speed and length of run of the electric lines, together with the growth of vehicular and other street traffic, brought about the removal of many street-car lines from the surface and the construction of new elevated and subway lines, which have become the main trunk lines in our metropolitan cities.

Conditions in American cities differ considerably from those abroad. The growth of these cities has been so rapid that it has been difficult to provide ample urban transportation facilities to keep pace with the steadily increasing demand. No sooner have the betterments referred to above been made than the demand has increased almost beyond the improved facilities thereby made available. The result, of course, has been that considerable crowding has characterized the rush-hour traffic and comfort is not a predominant feature of our street-car travel, at that time of day at least. However, the rush-hour traffic is due to the travel of people to and from work, and necessary promptness in reporting for duty and eagerness to get back home is responsible for our willingness to put up with discomfort in order to reach our destination quickly and surely. Consequently the European rule prohibiting any public conveyance from carrying more people than it has seats for will not do at all for an impatient American public.

While a reasonable amount of crowding has been generally tolerated in our large cities, excessive crowding or very irregular and inferior service quickly arouses vehement protest. On the other hand, the street-car company may be seriously hampered in rendering adequate service during the rush hours, due to lack of sufficient trackage to handle the traffic properly, to municipal regulations as to maximum speed, frequency of stops, headway between cars, etc., and to other local causes. It must be clearly borne in mind also that the extraordinary increase in length of

urban runs, liberal provision of transfers and requirements as to improved types of cars tend to increase the cost of hauling the average passenger. In Chicago, for instance, it is now possible to ride by street car some 28 miles on a single five-cent fare. Street-car companies are public utilities, but they are not charitable institutions. Capital cannot be invested in these enterprises without reasonable return.

However, the chief complaint regarding urban transportation service arises from excessive crowding during the rush hours. Electrical men know that peak loads are far less profitable loads than those at other times of the day. The same is true of peak or rush traffic. If it were within the power of a street-car company to put on more cars to accommodate the peak traffic, it would gladly do so were the peak not of such relatively short duration as to make the provision of the added facilities unprofitable. Moreover, lengthening out the rush-hour period, that is, flattening and broadening the traffic peak, increases the capacity of the equipment at hand, and in the case of those roads that cannot secure adequate trackage or terminal facilities gives them the opportunity to handle decently much more traffic than with a sharp peak. For example, making the peak traffic extend fairly evenly over three hours instead of one and a half, as is now the case in the evening rush, increases the capacity for handling the traffic comfortably very decidedly. It also increases markedly the likelihood of profitableness in handling this traffic.

How can this spreading of the rush hours be secured? Not through any drastic legislation, since this would be an invasion of the personal rights of the public. But by an educational and co-operative movement, taken up jointly by the traction interests, the municipal authorities, manufacturers and business men, much good could be accomplished. The public must first be informed of the difficulties connected with proper handling of rush-hour traffic and frankly told its uneconomical nature. When street and traffic congestion becomes a menace in a community, the public is glad to know of every means for removing or alleviating it. It should be first impressed on the people that it is a physical impossibility to give them adequate service as long as there is continued the custom of closing practically all shops, offices, stores and factories within a single hour and thus turning out hordes of people to jam the streets and public conveyances. It can then be shown that by a co-operative arrangement of the opening and closing hours of the larger concerns, at least, decided relief will be brought about in traffic. For example, many large factories begin and close work in different departments at different times, varying by 10 or 15 minutes. This not only relieves congestion of the entrances and approaches to the works, but permits a much smaller force of timekeepers to handle the work of checking the men in and out. The same idea can be worked out on a larger scale in relieving the traffic of an entire industrial or commercial district and with less equipment than is required now to handle imperfectly the concentrated rush. There is no reason why some concerns cannot close shop at 4:30 p. m., others at 4:45, at 5:00, and similar intervals up to, say, 6:45 p. m. Thus by a co-ordinated scheme the rush traffic can be spread out evenly over two or more hours, producing a much better load-factor, higher efficiency, improved economy and much better service than is possible with an irregular rush for a little over an hour, including a violent peak at 5:30 o'clock. In most places the morning rush is already more spread out than that in the evening and the service is better.

If the reform advocated above cannot be worked out completely, recourse must be had to other and auxiliary measures. Slow-moving traffic teams should be kept off the tracks as much as possible; as far as practicable car lines should be looped or through-routed so as to be impeded by intersecting lines or congested street crossings to the least extent; the number of avoidable stops should be cut to a minimum and in no case should more than 8 or 10 regular stopping points per mile be allowed. Thus the schedule speed can be increased and more seats passed by any point. With even these measures turning out to be inadequate, the final recourse is the removal of the tracks to an elevated structure or subway, entailing heavy capital investment and greatly increased fixed charges.

These various relief measures are by no means impracticable. Their execution would produce a most wholesome improvement in service, something that all utility companies in these days of commission regulation are compelled to give closest attention to. In fairness to the companies, however, it must be said that, if the public insists on riding 20 miles or more with liberal use of transfers on a five-cent fare, it cannot expect a very high quality of service unless it meets the issue half way and by a few simple concessions, such as those referred to above, makes it possible to render the service at a reasonable profit.

LAP WINDINGS.

Most of us are content to take the electrical machinery turned out by the manufacturer, and if it serves the purpose to which it is applied efficiently and well, to ask few questions as to the details of its construction. Such details receive the close attention of the designing engineer, the construction man in the shop and the repair men, but of only few other persons. To those who have to meet the problems of fitting designs to needs and to constructional conditions, every suggestion as to how to lay out windings is welcome, and it is to these that the article by Mr. E. M. Tingley, beginning on page 166, will principally appeal.

While the method proposed by Mr. Tingley may not be entirely new, it has not been generally used, and its virtues have been apparently overlooked by designers. Mr. Tingley gives tables showing the method for determining the group combinations for both two-phase and three-phase lap windings.

ECONOMIES OF ELECTRIFICATION.

While the advantages of electrification for the terminals and tunnels of steam railroads have been generally recognized, the economies of trunk-line electrification have not been so widely accepted, and many officials of steam roads have been unwilling to admit that they existed. It will require a number of main-line electrifications, covering different conditions, and showing definite statistical results, to bring about general acceptance of this claim. For mountainous country these figures, covering average divisions of trunk line, are likely to be available within a few years through the activities of the Chicago, Milwaukee and Puget Sound and the Norfolk and Western Railways, and to these may perhaps be added the Denver & Rio Grande.

Already, however, figures are available for a shorter length of main line covering the usual combination of passenger and freight traffic. The Butte, Anaconda and Pacific Railway has had actual experience with both steam and electrical operation over a line 26 miles long and totaling about 90 miles of track. There are eight regular trains per day over this road, in addition to ore haulage amounting to 5,000,000 tons annually. This will be increased about 25 per cent during the present year by the diversion of ore now sent to the smelters at Great Falls.

A comparison covering six months each of steam and electrical operation on this road has shown a net saving by the latter of more than 20 per cent of the cost of electrification. Larger trains are hauled, the increase in tonnage per train being about one-third, thus decreasing the number of trains. An increase of speed of about 30 per cent has accompanied the change. These figures leave no doubt as to the advantages of electrification in this case, and should inspire confidence in officials of other roads who have hesitated in changing over their mountain divisions even in regions where coal is not cheap.

COMPETITION OR CO-OPERATION.

A common practice in the past among electrical contractors whose business was not any too firmly established, was, when bidding on a job of electrical installation, to cut the price to any figure for which any other contractor could be induced to take it. Indeed, the cutting sometimes went even below this mark, where misrepresentation led to the belief that it was a question of cutting the price or losing the contract. The organization of electrical contractors and the wider dissemination of knowledge concerning correct methods of figuring costs is gradually rendering this condition obsolete, but much yet remains to be done. The contractor is learning that co-operation with his fellows is more to his advantage than cut-throat competition.

During the past ten days two state conventions of electrical contractors have been held, and this thought was the keynote of each. The prosperity of the contractor and the interests of the building owner in securing first-class work can only be promoted by an abstinence from price cutting, an insistence upon keeping bids above the estimated costs, and the segregation of contracts for electrical work from the general contracts for building construction. Only through co-operation can the contractors secure these conditions.

TRYING TO FORCE THE METRIC SYSTEM.

The present session of Congress is probably not different from others in the number of foolish bills introduced. Among this year's crop is one intended to establish the metric system as the standard for weights and measures, and which provides that this system shall be the sole standard in the United States after July 1, 1920. A penalty of fine and imprisonment is provided for the use in any industrial or commercial transaction of any other weights and measures.

Anyone familiar with the monetary system of the United States, and with the units of electrical measurement, must realize the advantages of a decimal system, and of the metric system in particular, since it gives such simple relations between the units of measurement of different quantities. It is to be hoped that enough others will realize the advantages to bring this system into general use in the near future. Before people are willing to do this, indeed before they can realize the advantage, they must become at least somewhat familiar with its use. One way for the Government to provide this familiarity would be to require the metric system in all government work and government purchases. Another pathway to this end is instruction in this system in the schools as a distinct system, instead of the practice, common at present, of teaching the children the conversion factors between metric and English units, the chief effect of which is to make the metric system appear very complicated. To try to force the system upon an unwilling country is, however, as foolish as it is impracticable. In any democratic country like this, it is impossible to drive the masses along lines which do not appeal to them.

The author of the present bill (H. R. 20526) appears to be entirely unfamiliar with present conditions. For instance, the bill provides that the metric units shall have definite relations to the present inch and pound avoirdupois, the author apparently not realizing that the present English units in common use are derived from a standard meter and a standard kilogram preserved by the Bureau of Standards at Washington. Moreover this bill would make the use of the common units of temperature, light intensity and other quantities for which no metric unit is provided, a misdemeanor, thus practically prohibiting measurements of such quantities.

Of course there is no likelihood of such a bill being passed by the Congress, but its introduction is another example of how little preparation is made by legislators for the duties which they undertake to perform.

Chicago Jovians Attend Beefsteak Dinner and Rejuvenation.

The Chicago Jovian League indulged in quite an innovation on the evening of Monday, January 18. This took the form of a well served beefsteak dinner at the Hotel Sherman, a high-class entertainment both musical and vocal under the direction of George Hull Porter by artists of exceptional ability being interposed between the courses. Immediately following the dinner, which was concluded before eight o'clock, the degree team put on a fine representation of the ritual and inducted a class of 30 candidates into the order.

The degree team was composed as follows: Jupiter, G. C. Richards; Mars, J. W. Foster; Vulcan, Otto C. Kaberna; Neptune, W. E. Finley; Pluto, T. H. Bibber; Hercules, Otis Johnson; Mercury, Charles Ffrench; Apollo, Otto Muller; Avrenim, A. J. Selzer. The Imps were Messrs. Swett, Hanson, Howe and Koch.

The smooth performance of the ritual was greatly facilitated by the work of S. Randall, as electrician; Morgan Ellis and Charles Dubsky, as stage managers, and H. J. Russell, Arthur Lubec and G. B. Weber, as stage assistants.

Pluto was well acted by Mr. Bibber, who was visiting in Chicago. It will be remembered that Mr. Bibber is the traditional Pluto of the Jovian Order, and his remarkable rendering of this difficult part of the ritual has added wide fame to the work of the New York Jovian degree team. Otto Kaberna, winner of the individual prize at the St. Louis Congress, gave an unusually perfect presentation of Vulcan.

There were about 150 Jovians in attendance who listened to short addresses by Homer E. Niesz, Reigning Jupiter; Sam A. Hobson, W. R. Bonham and A. A. Gray, V. H. Tousley, First Tribune of the Chicago Jovian League, presided.

Chicago Jovian Meeting

A very interesting address on "Progress" was delivered by Bishop Samuel Fallows before the Chicago Jovian League at its regular meeting on January 18. Bishop Fallows spoke of the progress that has been made in science, business, and religion during the years of his life, reciting many interesting incidents in connection with his early associations with electrical and other inventions that have now become important elements of our present civilization.

Minneapolis Jovians Learn About National Guard.

Captain C. C. Pulis, United States Army, addressed the Minneapolis Jovian League on the development of armament at its meeting January 12. The speaker described the types of light field gun used by the war department, and outlined his idea of how an effective National Guard could be raised in this country without excessive expense to the people.

Minneapolis Jovians have decided on February 26 as the date for their rejuvenation, which will be held jointly with the St. Paul League in St. Paul.

Street-Railway Service Standards.

Considerable agitation of street-railway service and "straphanging" has recently been indulged in Chicago by several newspapers and the municipal authorities. It was very appropriate, therefore, that at the meeting of the Electric Club of Chicago held on January 14 an illustrated address on this subject was made by Bion J. Arnold, chairman of the Board of Supervising Engineers, Chicago Traction. Mr. Arnold showed that on account of the local conditions in Chicago, with the great concentration of business in the downtown district, there would have to be more or less straphanging in the street cars in the business district during the morning and evening rush hours until sufficient additional trackage was provided to permit running enough extra cars into and out from the district to accommodate the traffic comfortably. The most logical way to provide this extra trackage is by the construction of subways that will take all through cars at least off the surface and enable them to run at high speed unimpeded by the varied street traffic. The city has had right along the power to enforce service betterment, but to exercise this power effectively service standards must be accurately defined.

Mr. Arnold declared that any attempt to enforce at all hours of the day a service standard ensuring a seat to each passenger would result in street rioting by impatient prospective passengers prohibited from boarding uncrowded cars. During the rush hours, therefore, the service standard would have to permit a reasonable number of passengers to stand. Several such standards were explained in detail and illustrated. These standards should apply not to individual cars, but to the average number of passengers carried per car by all the cars passing a given point in a definite period of, say, 30 minutes. The standard should be varied in step fashion for the different 30-minute periods during the rush hours. If the street-car companies provide all the cars that can be operated at safe intervals on the trackage available, further strict adherence to the service standard should not be required until additional track facilities are allowed to be provided.

President Pinckard presided at the Club meeting for the first time. Eugene A. Rummler was appointed chairman of a committee on constitutional revision. A. L. Millard was selected as chairman of a committee to consider consolidation of the Chicago Jovian League with the Electric Club.

Annual Meeting of the Illinois Electric Railway Association.

The annual meeting of the Illinois Electric Railway Association was held at the Auditorium Hotel, Chicago, on January 15, sessions being held both morning and afternoon. The morning session was called to order by Britton I. Budd, president, and the reports of standing committees called for. These included Executive Committee, Program Committee, and Publicity Committee reports. The latter Committee has prepared a map showing electric railways in the state of a size suitable for use on backs of letter-heads of member companies. This map was adopted for such use by the Association.

The election of officers, which took place at the morning session, resulted as follows:

F. E. Fisher, president.

J. R. Blackhall, first vice-president.

A. J. Purinton, second vice-president.

The secretary is selected by the Executive Committee, the members of which are: B. I. Budd, E. C. Faber, H. E. Chubbuck, W. C. Sparks, F. J. Baker, and Fred Janchey.

At the afternoon session, the report of the Signal Committee was presented by John Leisenring, chairman. This report dealt in a comprehensive manner with highway crossing protection for electric railways, and by means of stereopticon slides the various signals, gates, and other devices available for this service, were illustrated.

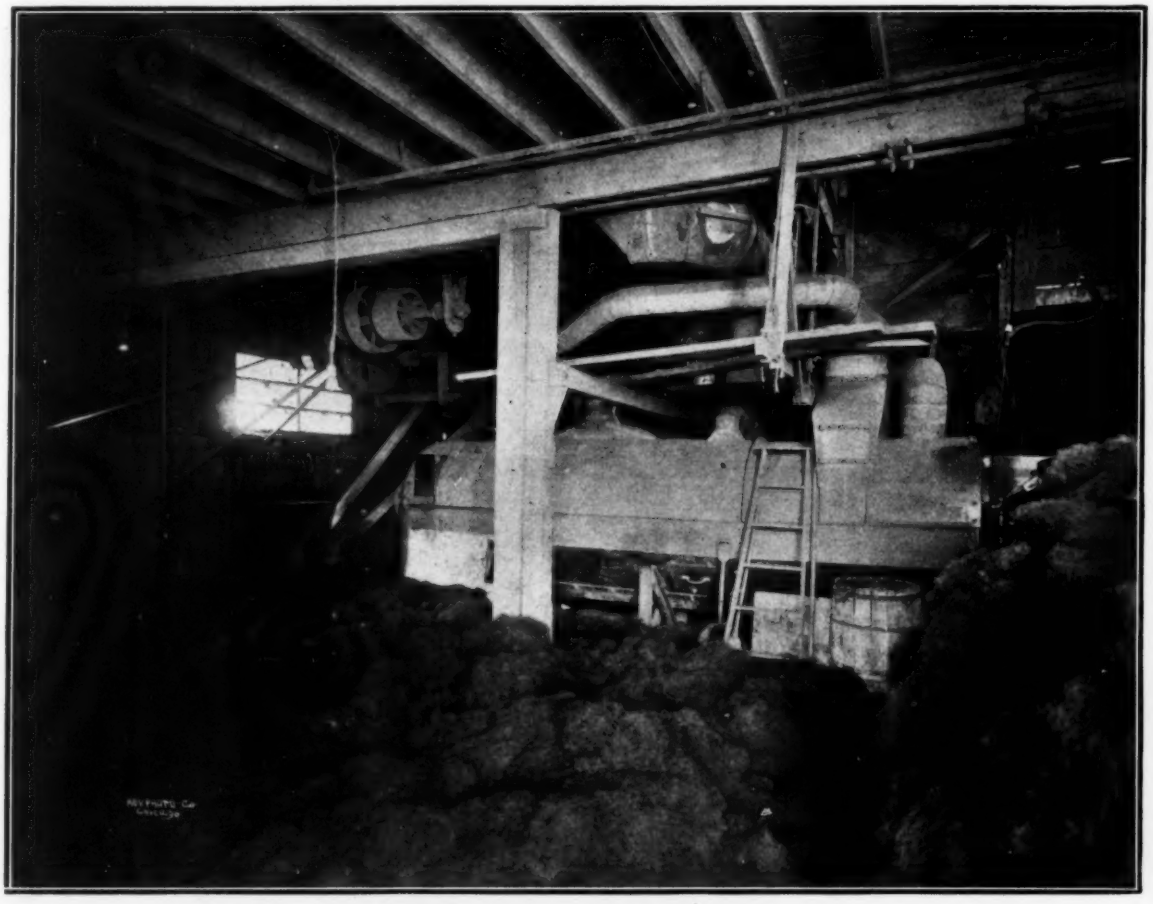
Kansas City Electric Club Introduces New Features.

The Electric Club of Kansas City, Mo., has inaugurated a program of industrial lectures, to be delivered by prominent men in other business fields, during the first half of the year 1915. The club meets twice each month. The first speech of the series was delivered on the first Tuesday in January, at the first meeting held since new officers were chosen by the club. The new president, E. E. Stigall, presided. Ralph Block, of the Kansas City *Star*, was the speaker. He spoke on "How the Business of a Newspaper is Handled." F. H. Penberthy, secretary of the Electric Club, states that this address and similar ones are considered valuable by the members for the insight which may be obtained in a study of business alien to the electrical field. A variety of topics is afforded also, thus giving a zest to the meetings which is sometimes lacking if "shop talk" is the principal staple of conversation. George Walker, manager of the lamp department of the General Electric Company, in St. Louis, told of the new department of the Jovian Order, that of the benefit fund for relief work and aids to members, and related also the plans under way for the development of the commercial division.

Electricity in Packing Plants.

The packing industry is represented by a comparatively few large plants, located mainly in Chicago, Omaha, Kansas City and New York, although small individual slaughter houses and packing plants are found in most all cities of reasonable size. In both classes of establishments the advantages of electric drive have long been realized, and while in many cases the present installations are simply the old system of line shaft drive with a motor or two substituted for the original engine, still it may be said that electrically driven plants are the rule and steam-driven plants the exception.

Although the larger packing plants, using large quantities of steam and hot water, can perhaps generate the bulk of the power required at a figure comparable with central-station service, these plants as well as the many smaller ones offer a profitable field for central stations for emergency, break-down and part service. Some information is given on a representative plant in Chicago.



Hair-Cleaning Plant Driven By 35-Horsepower Motor.

There has been considerable question as to the economy of purchased power in this industry, however, inasmuch as large quantities of steam and hot water are required in many of the processes. Under existing conditions it would, of course, be impossible for central-station companies to supply the entire power demands of the larger plants at a figure that would compare favorably with isolated-plant costs, but it is a significant fact that such mammoth establishments as Armour & Company, Swift & Company, etc., are buying increasing quantities of power from the central stations at Chicago and Omaha aggregating many thousand kilowatts.

This is profitable business for the central station and is business that is frequently neglected, the packing house being looked upon as a hopeless prospect, and, therefore, consistently avoided by the power salesman. The opposite attitude should be taken, however. In plants, even where unusual attention has been given the power proposition, and where efficient and economical operation is being obtained, an effort should be made to supply part power for operation on certain busy days of the week, or for overtime operation or for operating additional machines that may be added to the original equipment. Such practice is not only advisable, because of the current business obtained, but also is frequently the opening wedge for the entire business. Also in case of a breakdown, fire or other trouble in the customers' plant, the central station will be in a position to furnish service without delay, and thus demonstrate one of the important advantages of purchased power, namely, reliability.

The profitable business now being enjoyed by the electric companies in the various packing centers originated in the manner just described, and as the plants increase in size the additional power is being purchased from outside. Also, as the prime movers and generators of the packing plants become worn out or obso-

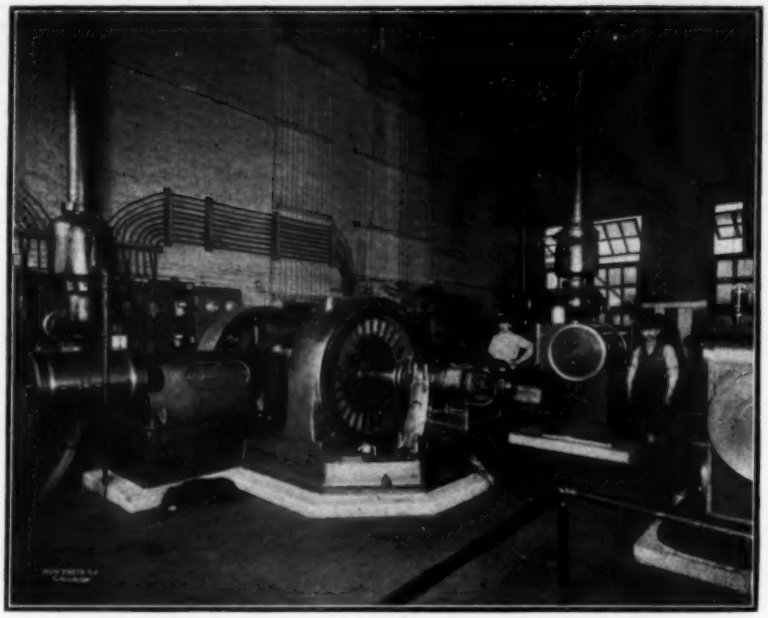
lete, central stations are called upon for this supply, and it is only a matter of time until the generating end of the plants will be discarded.

What has already been said applies particularly to the few large packing plants, where all engineering refinements have been adopted and modern boiler and engine-room practice obtains. It is true, however, that in many packing plants the engineering is looked upon as a necessary nuisance and expense. These plants can usually effect a saving by using central-station power, even though electric drive may be employed. The conditions in respect to packing plants employing mechanical drive were outlined in our issue of May 24, 1913.

Of the plants now operating with mechanical transmission, the larger ones and those most complex or widely scattered would naturally derive the greatest benefit by adopting central-station power. In such plants, the transmission is usually more complicated, changing floor loads make it more difficult to keep shafting in line, while developing conditions make frequent modifications and extensions to the transmission equipment necessary. To save time and expense, these changes are often knowingly made, not in a manner to get the most economical results, but in a way that will do for the time and avoid interruptions to business. In a packing plant it is essential that things be kept moving, and frequently unfortunate compromises are made in the machinery arrangements to accomplish this end.

It is a common occurrence that not all the departments of such a plant are operated continuously or simultaneously, therefore, in plants using mechanical drive it is necessary to operate the entire engine equipment if it is only desired to run one or two machines. A carefully determined and suitable arrangement of electric motors permits any or all departments to be operated at will, without the loss due to operating needless transmission equipment.

In a prosperous concern some departments develop, perhaps even reaching such proportions that it may become necessary to re-locate them. Another department shrinks or may be found to occupy space which could be used to better advantage for some other purpose. It is often found awkward to arrange anything like a good and economical plan for distributing power with shafting and belting, and departments are frequently, therefore, necessarily kept in awkward relations on this account, it being too expensive to re-locate them. With mechanical transmission it sometimes happens that the location of the power plant is a compromise or makeshift arrangement, brought about by the necessity of getting at the main lines of shafting. It may occupy space which could and naturally would be used to good advantage for productive purposes. The elimination of the innumerable belts inseparable from mechanical drive also increases safety to operatives, eliminates dirt, which is of paramount importance in plants manufacturing food products, and in addition greatly improves lighting conditions.

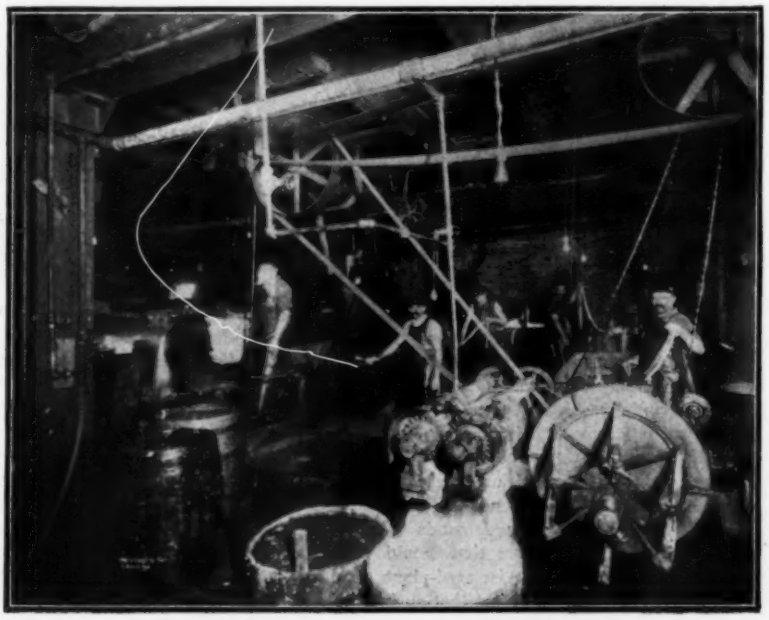


Power Plant Prior to Introduction of Central-Station Service.

With motors, if group drive is adopted belt speeds are usually higher and the belts consequently smaller. The motors are placed on ceilings, walls or floors, as may be most convenient, and drive in any direction, thus permitting arrangements to be made which are best suited to the various conditions. The controlling switches should be placed convenient for use in starting or more especially in stopping, should accident occur which requires prompt action in shutting down the machinery. At the same time they should be located where least liable to damage.

The Western Packing and Provision Company of Chicago is one of the larger plants which has recognized the advantages and economies of electric drive and central-station service, all of the energy used at this plant being furnished by the Commonwealth Edison Company.

The processes involved in the average packing plant are comparatively few as regards power applications. Beef killing and dressing is done by hand. Motor-



Motor-Driven Rotary Separators for Removal of Fat.

Corner of Beef-Dressing Floor.

driven conveyors and hoists are used to some extent in the dressing departments but outside of refrigeration and ice-making machines, the greatest amount of power is used in manufacturing and handling by-products.

In hog killing, a motor-driven Ferris wheel is used to lift the hog from the pen to an overhead trolley on which the hog journeys until cut and dressed for packing. The hog wheel at the Western Packing Company's plant has a capacity of 3,600 hogs per day.

One of the accompanying illustrations shows the gut-fat room of the Western plant which represents one of the most interesting departments of the establishment. Here the fat is removed from the intestines by means of motor-driven separators. It is interesting to note that the revenue from this fat, together with the revenue from the cleaned gut, blood, and hair represents practically the entire return the packing house receives for the operations of purchasing, yarding, killing, dressing, chilling and delivering the meat to smaller plants and dealers.

Another illustration shows the hair-cleaning department, where another profitable by-product is obtained. The motor, in this department is of 35-horsepower size. The dust removed from the hair assays under government test at $42 per ton for fertilizer. The revenue from this source is sufficient to pay all operating and overhead charges of the department and at the same time the cleaning processes practically doubles the value of the hair.

The accompanying view of the dressing floor shows the "knocking pens" to the right. These pens are self dumping and are operated by individual motors. When the animal is killed the attendant throws a switch which raises a side door, at the same time elevating one side of the floor. The carcass is then tied and raised to the overhead trolleys by means of motor-driven hoists. The average output of the floor shown is about 250 head per day.

Particular attention is called to the illustration showing the travel of carcasses through the plant. When once a hog or a beef is started on its journey through the plant, no stop is made until the cooling rooms are reached. The various processes, some motor operated, have become so specialized that even a trivial delay in any one department will affect the continuity of operation in other sections of the plant. This phase of packing plant operation emphasizes the extreme importance of reliability of power service and should also emphasize the value of central-station power in this connection.

The operation at the Western Packing and Provision Company's plant since the adoption of central-station service has been extremely satisfactory and economical. The accompanying data show the results of tests conducted by the engineers of the Commonwealth Edison Company, and represent average conditions.

Artificial refrigeration has probably been the most important factor in building up the year-round packing business as it is now conducted. Previous to the introduction of these machines only local

Energy Consumption and Output of Various Machines at Western Packing & Provision Company.

Operation	Amount of Material	Kilowatt-Hours	Kilowatt-Hours per Unit
Ferris wheel	2995 Hogs	46	0.015
Hog scraper	2995 Hogs	391	0.13
Hog conveyor	2995 Hogs	21	0.007
Hog drop	160 Hogs	1.2	0.0075
Small elevator, conveying refuse from hog killing floor to basement	2995 Hogs	15	0.005
Cattle conveyor hoist	598 Head	140	0.234
Hair cleaning machine	400 pounds Hair	12	0.03 per pound
Gut cleaner	500 Set Guts	4	0.008 per set
Gut washer	44 Set Guts	3	0.068 per set
Fertilizer mill	800 pounds	40	0.05
Oleo hasher	2500 pounds	8	0.0032 per pound
Oleo press	15360 pounds	6	0.00039 per pound

Hog Carcasses on Motor-Driven Trolley.

markets were supplied with fresh meats during the warm weather.

Motor-driven refrigerating equipment is now firmly established in the industry and adequate data are available on installations of any magnitude. The power required to drive a refrigerating machine depends to a great extent upon the temperature of the water used to cool and liquefy the compressed gas. The lower the temperature of the water, the smaller the power required.

It has been found that, under proper conditions, one ton of refrigeration will cool from animal temperature to keeping temperature from 15 to 24 hogs, weighing 250 pounds each; from 5 to 7 beeves, weighing 700 pounds each; from 45 to 55 calves, weighing 90 pounds each; from 55 to 70 sheep, weighing 75 pounds each.

After cooling, one ton of refrigeration will preserve one ton of meat for 24 hours, when stored in the proper boxes.

Commercial Practice
Management, Rates, New Business

ELECTRICITY IN RURAL DISTRICTS.

Data on Threshing in an Iowa Community.

With the ever increasing network of electrical transmission lines in rural districts, the supply of electricity for use on the farm becomes possible. The modern farmer is not far behind his city brother when it comes to the conveniences of modern methods. He will use the electric motor if he can be shown that it will lighten the farm labor. He will light his house and barns with electricity. He will use electric washing machines. He will pump water for his house and barns with electric motors. Feed cutters, churns, threshing machines and various other machines can be driven by electric motors. An electric motor mounted on skids, or a cart will do many of the barn yard chores in a small fraction of the time it takes to do them by hand, allowing much more time for the things that must be done by hand. A length of flexible cable on a reel; can be mounted with a motor to make it portable, or the service wires can be carried on a permanent pole line, to the various points where the motor is to be used.

Rural dairies can use electric drive for cream separators, churning and even milking machines, and save an enormous amount of manual labor. The decreased cost for labor will pay for the motors in a very short time.

The farmer, better than anyone else, knows how hard it is to get "hands" when he needs them most. Any device that will emancipate him from the uncertainties of farm labor will be welcomed on the farm. The electric motor will quickly do many of the "chores" that the farmer now has to do by hand, thus saving him many hours that can be devoted to the crops.

The time is not far distant when every farmer along the lines of the power company will have his electric motors. Those farmers who are away from the power lines will demand power service sooner or later, so that the stations will find it profitable to supply all but the most remote.

Several progressive farmers along a transmission line in Iowa made provision to obtain electric service. They then bought a 30-horsepower Wagner single-phase motor, to replace the old worn-out steam engine that formerly was used to run their threshing machine.

This they mounted on the truck of an old grading machine, along with the switch, fuses, etc. As the voltage supplied them was 2,200 they mounted a ladder-pole and a transformer on the same truck. The ladder-pole supported the wires from the nearest pole on the transmission line. The transformer reduced the voltage from 2,200 to 220 required for the motor. The accompanying illustrations show the motor and its mounting and the motor in operation, driving the threshing machine.

Motor Mounted on Old Truck.

Motor Driving Threshing Machine.

DATA ON THRESHING GRAIN USING ELECTRIC MOTOR.

Grain	Bushels	Kilowatt-hours	Kilowatt-hours Per Bu.	Cost in Cents Per Bushel at 5 Cents Per Kilowatt-hour
Barley	1150	140	0.1217	0.608
Oats	1125	73	0.0649	0.324
Barley	1800	278	0.154	0.77
Barley	1045	160	0.153	0.765
Barley	1375	170	0.123	0.615
Barley	1045	160	0.153	0.765
Oats	720	67	0.093	0.465

The cost of threshing is given in the table herewith and is less than the cost when operating the steam engine. The cost of a new steam or gas engine

in this case would have been $1,800 to $2,500, while the motor outfit complete cost only $800. Thus, when depreciation, interest on investment, etc., are considered, the cost of threshing by electricity could be figured to be 25 per cent less than by steam or gasoline engine.

Herewith are presented data on the horsepower requirement of a few of the machines ordinarily used on a farm that can be economically driven by electric motor. Minimum requirements are given in each case.

Machine	Horsepower
Cream separator	0.5
Milking machines	0.5
Wood saw	3
Washing machines	0.25
Grindstone	0.25
Ensilage cutter	10
Feed grinder	5
Corn sheller	0.5
Hay press	3
Refrigerating machine	0.5
Threshing	30
Water pump, depending upon amount of water and lift	1
Churning	0.5
Ice-cream freezer	0.5

One of the illustrations shows a two-horsepower Wagner single-phase motor used for pumping water on a farm. By providing storage tank, the farmer may have his own water supply system. The operating switch may be controlled by a float and thus always insure an adequate supply of water. He may then have running water in the house and in the barns, with their attendant conveniences and safety, such as completely equipped bath room, sink, and fire protection. The latter is of great value, as millions of dollars have been lost yearly by farmers, due to inadequate fire protection of the farm buildings.

Motor Used for Pumping Water.

Individual Drive in Textile Mills.

J. F. Crowley in a paper on the electrical equipment of textile factories gave the following results of a test showing the advantages of individual drive over group drive. Six looms were under test and a 20-hour test with group drive was followed by a 20-hour test on the same looms on individual drive.

GROUP DRIVE.		
Total number of picks	187,876	
Consumption of motor, shafting, belts and looms	72	Kilowatt-hours
Consumption of motor, shafting, belts and loose pulleys	32	Kilowatt-hours
Apparent consumption of looms	40	Kilowatt-hours
INDIVIDUAL DRIVE.		
Total number of picks	361,206	
Consumption when driving looms	53	Kilowatt-hours
Consumption for 187,876 picks	27	Kilowatt-hours
Actual consumption of looms (motor efficiency 75 per cent) = 75x27	20	Kilowatt-hours

Mr. Jones, in his address, referred to the opportunities afforded the employees of the Brooklyn Edison Company to invest in the company's stock, stating that at present employees were represented to the extent of a half million dollars. He spoke also of the increased business of the company, and by means of lantern slides showed many interesting and notable local installations of central-station service. He referred particularly to a large power contract which calls for power and lighting of the large cordage mill of the American Manufacturing Company, the estimated minimum annual power consumption of which will amount to more than $120,000. He stated that in order to secure this contract, is was necessary for Mr. Jones and his associate to obtain the consent of an English consulting engineer, and a trip to England had to be made for this purpose.

T. W. Flowers, of the auditing department, presented a paper dealing with the work of this department.

Other speakers of the evening were John Meyer, of the Philadelphia Electric Company, C. G. N. Thomas, New York and Queens Electric Light & Power Company, R. R. Young, Public Service Electric Company, H. M. Wilson, of the *Electrical World*, and Charles W. Price, of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

Meeting of Brooklyn Section, National Electric Light Association.

The January meeting of the Brooklyn Company Section of the National Electric Light Association was held in Brooklyn, N. Y., January 12. Addresses were made by W. F. Wells, vice-president and general manager, T. I. Jones, general sales agent, T. W. Flowers, and others. Mr. Wells, speaking on the outlook for 1915, reviewed the evidence of the revival of commerical activity in this country, saying that shipping has been resumed, factories are working night and day, shoe and clothing manufacturers are kept constantly at work, and all indications point to an early restoration of prosperous conditions.

Low-Cost, Free-Service House-Wiring Campaign for Louisville.

With propositions providing cheap installations on easy payments in workingmen's four-room cottages and one month's free service in better-class houses, the Louisville Gas and Electric Company, through Robert Montgomery, manager of its commercial department, is going after very much increased gains in its house-wiring campaign this year. In both cases 11 of the leading contractors of the city are working with Mr. Montgomery.

The free-service plan will apply to all householders who enter into contracts between now and June 1, provided the installations are immediately connected, while no limit is placed on the amount of current which can be used. This service will be receipted for on presentation by the subscriber of the order to that effect given by the contractor doing the work. The proposition is good whether the contract is solicited by the company or by the contractor.

Heretofore the four-room cottage installation has amounted to $30 on a minimum basis but the special proposition, which is to run indefinitely, calls for a flat rate of $23, with a discount of $2.60 for cash. It provides for a two-lamp fixture in each of two rooms and one-lamp fixture in each of the remaining two rooms, with shades and Mazda lamps furnished. The account is payable $5 in cash on completion with $1.50 monthly until cleared up. The plan applies only to four-room cottages, or those with fewer rooms, a great many of which are to be found in Louisville. It is a proposition originated by Mr. Montgomery and has been received favorably by the contractors, who by co-operative buying, will be able to fulfil the contracts.

Electrical Construction

Bell-Ringing Transformers.

The bell-ringing transformer is used in houses which are provided with a supply of alternating current at some commercial voltage, such as 110 volts, for the purpose of ringing bells, furnishing current at low voltage to signaling systems, or in other apparatus which is used intermittently, and does not require very high current or voltage. The use of such a device avoids the necessity of giving periodic attention to the batteries which must otherwise be used for such purposes. Where the commercial supply for lighting is not alternating, but direct current, the bell-ringing transformer cannot be used, and bell circuits must be provided with batteries. Arrangements have been devised for ringing bells by the use of energy from the commercial circuit under these circumstances, but apparatus for this purpose is not

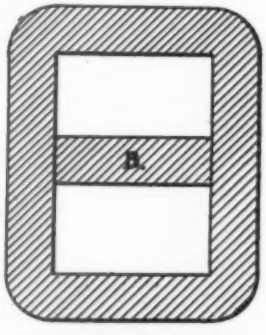


Fig. 1.—Transformer Core.

within the province of the present article.

The objection to using the commercial lighting voltage directly on a bell circuit with push button is that even though sufficient resistance be inserted in the circuit to prevent too large a current, there is danger of arcing taking place at the push button or other device where the circuit is broken. Such an arc, produced by commercial voltage of 110 volts or higher in an ordinary push button, may do considerable damage by setting fire to a building, and in any case its own contact points are likely to be so injured as to create trouble.

The bell-ringing transformer is exactly similar in principle to other kinds of transformers which are used for power and lighting purposes, and depends for its action upon the general principle of electromagnetic induction. The transformer consists essentially of two coils or windings, generally called the primary and secondary, and of an iron or steel core which constitutes a magnetic

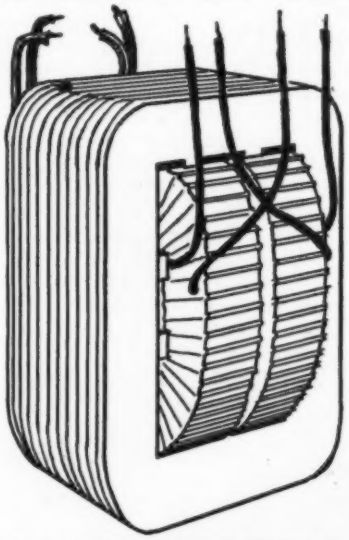


Fig. 2.—Transformer With Windings in Place.

circuit. The parts are so arranged that this magnetic circuit is linked with the two electrical circuits. Fig. 1 shows the steel core or magnetic circuit before the windings are placed upon it.

The application of voltage to the primary windings causes a current to flow in this circuit which produces a mag-

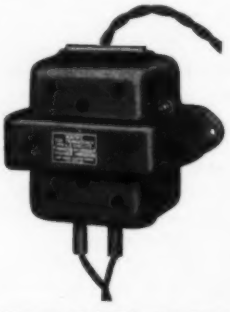


Fig. 3.—Wayne Bell-Ringing Transformer.

netic flux in the magnetic material of the core. If the primary current is alternating in direction this magnetic flux will also alternate in direction. The continual change in the amount of magnetic flux linking the secondary circuit causes an electromotive force to be induced in this winding, and this also will be alternating in direction. The primary circuit will also have an electromotive force induced in it by the magnetic flux of the core, and this will be in such a direction as to oppose the external electromotive force which is applied to the primary, and consequently will limit the current which flows into the transformer from the source of supply. The values of the electromotive forces which are induced in primary and secondary windings are proportional to the number of turns in each of these windings, respectively. By properly choosing the number of turns, the primary winding may be designed for any available voltage, and the secondary winding will give any voltage desired for the operation of the bell circuit. By bringing taps out from the winding at intermediate points, it

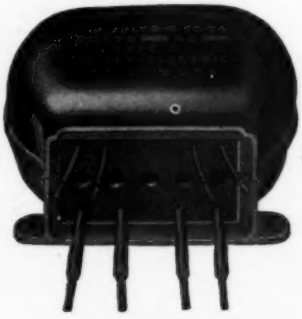
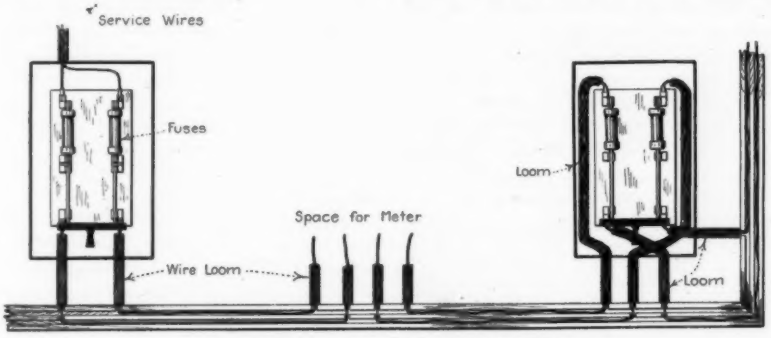


Fig. 4.—Transformer With Taps for Different Voltages.

is possible to provide a choice of secondary voltages. Sometimes, too, the primary is similarly provided with extra terminals suitable for other voltages. This is shown in Fig. 2, where both primary and secondary are provided with four terminal wires. The most common voltage for the secondary circuit of a bell-ringing transformer is eight volts, but some commercial transformers of this type are wound for lower voltages and some have taps supplied which permit various voltages to be obtained from 2 volts to 18 or 24 volts.

Since the bell-ringing transformer is intended to be installed in premises where it will operate without any attention, and since such attention as it does receive will probably be from persons who are not electrical experts, it

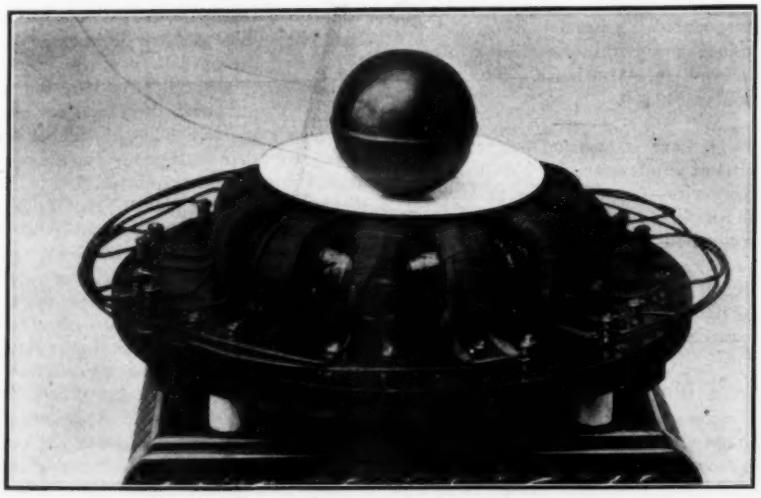
is important that the design and construction of this apparatus should receive most careful attention in order that it shall be safe when installed. As ordinarily used, such transformers are left permanently connected to the line, and they should, therefore, take a very limited amount of power. It is generally regarded that 25 watts is the maximum power that should be taken by this device, even when the terminals of the secondary circuit are short-circuited. This can be arranged by a suitable choice of windings. The design, also, should be such that when left with the secondary permanently short-circuited, the heating will not be sufficient to do any damage.



Meter Board with Switch Cabinets in Position.

The insulation of the primary winding should receive especial care, since this winding will be connected to the 110-volt circuit. Both the primary winding and the wires which lead to it should conform to the rules of the National Electrical Code for low-potential inside work. For connection to the supply wires, the primary leads should be brought out of the case in the form of stranded rubber-covered wires not smaller than No. 14, and at least six inches long. After the transformer is mounted in position, connection can be made to these leads. Each of the primary leads should be brought out through a separate hole in the transformer case, provided with a suitable bushing.

A bell-ringing transformer should be mounted inside of a substantial and secure case, preferably of iron, which will protect the transformer from mechanical damage and from moisture. This case should be provided with lugs for mounting, and these lugs should project so that there will be an air space left between the case and the surface upon which it is mounted of not less than one-quarter inch. The transformer case should be provided with a name plate, giving the voltages for which the windings have been designed, and also stating the frequency, capacity, name of maker, etc. The secondary terminals may consist of binding posts, if desired. These terminals should be marked with the word "Bell," and the primary terminals should be marked with the word "Line."



Apparatus for Demonstrating a Rotating Magnetic Field.

Typical bell-ringing transformers are shown in the accompanying illustrations.

When installing a transformer upon a bell circuit, it is advisable to see that the bell is suitable for the purpose, as many bells which operate all right on two cells of battery do not give satisfaction when operated upon the higher voltage from the transformer. Since the latter supplies an alternating current, a bell which is designed to operate with alternating current of the given frequency will give the best results. There is no necessity for a make and break in the circuit of this type of bell, and all trouble from arcing at the contacts is thus eliminated.

Meter Loops for Pipe Service.

In Asbury Park, N. J., and vicinity a pipe entrance for service wires is required on all new installations. The meters generally used are arranged for bottom connection of both line and load wires, in the case of a two-wire installation. The following arrangement of switch cabinets and meter has been found very satisfactory. It is illustrated in the accompanying diagram.

First mount a meter board about 3 feet long and 1.5 feet high. Drill the boxes for the switches and punch out the required knockouts. Then set the boxes and switches, one being provided on the line side for the operating company to seal and one on the load side of the meter for the consumer's use. A strip of wooden molding is notched out to accommodate the wires, and nailed along the bottom of the board. At the right side a short vertical piece is mitered to this, to accommodate the wires leading to the distribution center. Wires are brought out for the meter loops leaving about 10 inches of wire and 4 inches of loom on each.

When connecting wires from the molding to switch, loom right up to the setscrew to avoid the necessity for taping. After the casing is put on with finishing nails, give the board two coats of black asphaltum or similar compound.

When finished this makes a very neat board and does away with unnecessary loose wires. It has been approved by the city inspector.

Ernest Kinerim.

Demonstrating a Rotating Field.

There are several ways of demonstrating the rotating field of two and three-phase motors, and the following is a description of apparatus which has been used by the writer with great success. The accompanying illustration shows the general appearance.

The core is seven inches in diameter inside, having a cross-sectional area of two square inches. It is made of stovepipe iron wire wound on a form, then taken off and thoroughly annealed.

The coils, 12 in all, are wound with 300 turns each, of No. 20 double-cotton-covered magnet wire, the leads being brought to binding posts so that dif-

ferent combinations of connections can be made.

A hollow or solid copper or brass ball placed on a dinner plate over the coils, or a coffee-can cover held by a nail will spin at a good rate of speed.

By using a phase splitter composed of resistance and reactance and connecting the coils four-pole, single delta, the writer has used this outfit on single phase to show the working principle of starting the split-phase motor.

Connected single star, four-pole, this outfit has been used continuously on a 60-cycle, 110-volt, three-phase circuit without undue heating.

Everett M. Russell.

An Accounting System for Contractors.

An accounting system which is applicable to the business of the electrical contractor and others engaged in mechanical construction work has been worked out by George W. Hill and C. A. Walker. This system contemplates the use of blanks which are prepared and furnished to the contractor with instructions how to properly make the entries to carry out this method. All of the columns in each page are numbered and lettered so that it is easy to follow the instructions and if these instructions are followed one cannot avoid keeping a complete record.

The books which are kept under this system are of the loose-leaf variety and are bound in Keratol leather. There are five of these books. One is a ledger which does not differ essentially from an ordinary ledger account book. The second is a combined journal, cash book and daily financial statement. The third is a transfer book for the leaves of the latter. The fourth is a job-cost book and sales record and the fifth is a transfer book to which the job-cost sheets are transferred whenever a job is completed.

The job-cost book includes a sheet for a monthly financial statement which automatically gives the net gain or loss for the month, the overhead expense which has been incurred and an inventory of merchandise. This book shows also the itemized cost and profit on each job, the cost of productive labor and material, the gross amount of charge sales and of cash sales, as well as a complete history of each job.

The combined cash book, journal and financial statement carries a complete balance at all times showing the true condition of the business.

The use of these books will automatically teach a contractor how to do bookkeeping, since, if the instructions are followed, he cannot go astray. The debit columns are all headed with a letter A and the credit columns with a letter B. For every entry in an A column there is a corresponding entry in a B column, thus carrying out the principle of double-entry bookkeeping. The method is applicable to any size of business and if the books are kept posted a statement of the business can be taken off at any time in a few minutes.

The system will be put out by the H. & W. Accounting Bureau, Rock Island, Ill., which will also give any needed assistance for a period of one year and the books contain sufficient blanks for the same period. A book of instructions accompanies the set of books and at the end of the first month the Accounting Bureau will see that a financial statement is properly taken off and give any assistance that may be necessary to do so. It is intended to supply this set of books with instructions for $50 to non-members and for $35 to members of the National Electrical Contractors' Association.

Among the Contractors.

The Hub Electric Company has been formed in Chicago, Ill., through the consolidation of a number of firms which have heretofore been operating independently. These are: R. C. Bierdemann Company, Alex. M. Knauber Company, Franklin Waidner, F. L. Decker, Samuel Benson, J. P. Kerns. The new headquarters are at 1819 and 1821 Carroll Avenue. W. J. Collins, formerly executive of the Faraday Association, is manager of the new concern.

At Sioux Falls, S. D., W. C. Bessler, G. H. Bessler and F. H. Bessler have incorporated the Electric Shop and will conduct a general electrical construction and sales business. The capital stock is $10,000.

J. H. Carr is entering business as an electrical contractor in North Adams, Mass., with shop and office at 11 North Holden Street. He will specialize in the introduction and installation of small power plants for farmers and others in outlying districts. Great development is expected in these lines in Western Massachusetts.

Marking Ammeters.

Engineers in charge of alternating-current apparatus furnishing current to systems characterized by a low power-factor, as shown by a considerable difference between the "kv.-a." and the "kw." readings, should have the safe maximum limit in amperes marked in red upon all ammeters. This will tend to obviate the practice of operators depending upon the wattmeter readings for the capacity of the apparatus, which is attended with danger.—*Power.*

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN.

Annual Convention at Milwaukee, January 18, 19 and 20.

Despite present business conditions, the best convention ever held by the Electrical Contractors' Association of Wisconsin was its twelfth annual meeting held at the Hotel Wisconsin in Milwaukee on Monday, Tuesday and Wednesday of this week. Closed business sessions were held on the first and third days; on the second day two open sessions were held, followed by a banquet in the evening.

The convention began on Monday afternoon with a business session at which routine matters and association affairs were taken up and informal discussion of contracting problems indulged in.

The open session on Tuesday morning was called to order at 10 o'clock by President W. R. Johnson, of Wausau. G. W. Hill, special representative of the National Association of Electrical Contractors, spoke commendingly of the work on liability insurance undertaken by E. J. Burns in Illinois.

The Jobber.

H. P. Andrae, of Julius Andrae & Sons Company, Milwaukee, read a paper entitled "The Jobber in the Field." He showed that to start a retail store an electrical contractor would need to purchase some 1,000 separate articles made by about 100 manufacturers. To buy these items directly from the manufacturers would involve a great deal of correspondence, delay and troublesome annoyance compared to the simple and expeditious transaction of a lump purchase through a jobbing house.

He cited the case of some manufacturers who thought it would be worth trying to sell their products directly to the consumer. The high cost of selling, together with the restricted volume of sales, soon convinced them that it was not the best plan. The fear has been expressed that the jobber may himself undertake to manufacture goods similar to those he is acting as agent for; however, the jobber does not manufacture, and does not wish to manufacture. His aim is to sell products only, and he devotes all of his attention to becoming an expert in selling. He organizes an extensive sales force that travels continually throughout his territory. If the manufacturer would undertake a similar comprehensive traveling sales campaign, he would have to have a very large sales force, with heavy incidental expenses. All this can be eliminated by turning over sales to the jobber. Other items saved are on packing, billing, and collecting. By turning over his product to jobbers, the manufacturer need carry only a few

large accounts, which are easy to keep and to collect. Thus he is saved much expense and inconvenience by this procedure. Mr. Andrae illustrated his points by numerous typical cases, one in particular showing how bicycles at first were sold direct from manufacturer to user, at very heavy expense. As soon as this business was turned over to the jobber the selling cost was greatly reduced and the final cost of the wheels likewise brought down.

The Contractor.

D. E. Roberts, of Racine, then addressed the Association on the title, "The Contractor in the Field." He spoke from an experience of some 30 years in the electrical contracting business, going back to the time when it was necessary to send to New York in order to get insulated wire. He told of the case of one of his friends who, in order to make some magnetos, had to insulate his own wire, wind his own coils, and make the entire equipment in his own shop. A wonderful advance has been made from those early times. Now the contractor has all his materials and supplies ready-made; it is necessary for him merely to assemble a few parts and install the equipment. The manufacturers and jobbers have aided him at every point to facilitate his business.

A young contractor, just engaging in the business, must supply himself not only with good materials and supplies, but must map out his entire business for success. One of the most essential elements is to get the best possible workmen and associates, men who are both experienced and dependable under all conditions. However, many young upstarts have gone into the business on very limited capital, securing extraordinary credit from jobbers, and then cutting prices so that ultimately they were not only themselves driven out of business through failure to make any decent profit, but in the meantime injured the already established contracting firms. In strong terms, Mr. Roberts paid his respects to the practice of price-cutting, and hoped that the time will come when everyone will pay cash for his purchases, thus solving the problem of too liberal credit for persons who do not deserve it.

However, it is necessary to acknowledge the good work done by the jobbers in facilitating the business. One secret of their success is that they are masters at co-operation. For instance, in Kansas alone, during the last few years, some seventeen jobbers have gone into the business. This growth of the jobbing business is due almost entirely to good organization. Why cannot the contractors take a lesson from this and also co-operate? He cited the merging of the interests of six contractors in Chicago as a good example of co-operation. It is necessary to get reasonable prices for work done. Organization must be undertaken and, of course, on a fair basis.

Contractor's Accounting.

G. W. Hill then presented a paper on bookkeeping and accounting for contractors. With the aid of numerous lantern slides, he showed the system developed by him, and which is described in detail on another page of this issue. He showed that 75 per cent of contractors fail in business, and of this number about 55 per cent fail because they do not know their costs. The contractor should make a financial balance of his business at least each 30 days. He pointed out errors commonly made by the one-man contractor; also the wrong method commonly applied in figuring "overhead." He showed the danger of taking unit costs except from the records of a contractor's own business, because average unit costs in other localities, and under other conditions, may not represent the actual local conditions prevailing.

L. W. Burch, of Madison, emphasized the need for keeping accurate books. This is absolutely essential, and the only safe way to carry on any business. He highly commended the system described by Mr. Hill, and declared it to be the acme of simplified and yet complete bookkeeping systems. On his motion, the Association recommended the system for adoption by the National Association of Electrical Contractors.

G. B. Muldaur was the first speaker in the afternoon session, taking up for his topic the objects and work of the Society for Electrical Development. Primarily its object is to bring about the co-operation of all electrical interests, so as to further the sale of all electrical equipment. This has been carried out to a very large extent by facilitating the co-operation of contractors and central stations, between whom there formerly was more or less antipathy. Of the total membership of our 1,200 in the Society, something like one-half consists of contractors. The Society is trying especially to reach the smaller contractors and dealers, who are in greatest need of its expert help.

Illumination and High-Efficiency Lamps.

An illustrated paper, entitled "Illumination from Concealed Sources," was presented by L. G. Morgan, of the National X-Ray Reflector Company. He made a strong plea for absolute indirect illumination, claiming it to be superior to all other methods of artificial lighting. He gave numerous references from reports of committees, from papers presented before the Illuminating Engineering Society, and from other sources, bearing out his contentions. He then described in considerable detail the manufacture and characteristics of the reflectors manufactured by his company. Many views were shown of typical installations of indirect lighting. One of these in the scarlet-fever ward of the Milwaukee Isolation Hospital demonstrated, according to the report of the attending physician, that this system of lighting no longer affected the eyes of the patients, something that had always been very troublesome with the direct lighting formerly used.

Earl A. Anderson, of the National Lamp Works of General Electric Company, then presented an illustrated paper entitled "The Incandescent Lamp Developments of 1914." He traced the development of the incandescent lamp from the time of its invention up to the present, and showed the great increase in efficiency attained, particularly in the last two years. He described the new gas-filled tungsten lamps, and explained their characteristics. Some of these were also demonstrated by means of experiments. The peculiar adaptability of these lamps to purposes for which incandescent units had hitherto not been used was explained, particularly their use for daylight lighting, portrait photography, color matching, projecting purposes, etc. Street lighting was referred to at length, and the types of lamps and equipment especially designed therefor described. Flood lighting was also touched on. In closing, Mr. Anderson spoke of the precautions necessary in using the new lamps to the best advantage. He said that much erroneous information has been disseminated respecting the heating caused by these lamps, and cited several tests where such lamps had been burned close to strong gasoline vapors, showing that they are not the great fire hazard which has been stated.

C. Lloyd Chaffee, a senior student in the electrical class of the Milwaukee School of Engineering, then gave an illustrated lecture and demonstration on wireless telegraphy. The equipment he used was almost entirely made by amateurs, and the experiments performed were such as could readily be made. Among these was the wireless opening and closing of a number of circuits.

The annual banquet of the Association was held on Tuesday evening and was very well attended. An excellent dinner was served, after which addresses were made by G. W. Hill, William T. Goffe, and A. F. Sheldon, of the Sheldon School of Salesmanship, Chicago.

At the closed sessions on Wednesday, two papers were presented as follows: one by C. Netzhammer, of the Northwest Furniture Company, on the subject "Where to Put and Where to Find It;" another, by C. R. Kreider, of Kohler Brothers, Chicago, on "Estimating." Much informal discussion of the problems now besetting the electrical contractor was indulged in, and official business concluded.

ILLINOIS CONTRACTORS HOLD SEMI-ANNUAL CONVENTION.

Oppose Introduction of Concentric Wiring.

The Electrical Contractors' Association of the State of Illinois held a convention at the New Morrison Hotel, Chicago, on January 15 and 16. This was a notable meeting and brought out a record attendance. The total registration was 204, being made up of 86 contractors, 75 ladies and 43 representatives of the manufacturers, jobbers and others.

The opening session was held on Friday morning, when an address was made by H. N. Tolles. This attracted great attention from the contractors, and contained many points of interest and value along the lines of securing more business and properly organizing it.

Charles Umbach, president of R. Williamson & Company, made an address on "Practical Organization Work."

At the afternoon session reports were presented by the secretary and various committees. Secretary E. J. Burns pointed out the great advantage accruing to the members through placing liability insurance through the Association. The saving to individual members varied from $25 to $500 and averaged $66.23. At the same time it turned into the treasury of the Association a commission which aided in defraying the expenses. The minimum premium has been reduced from $50 to $25. Membership in the Association costs on an average about $28, this amount being made up of dues and the special assessment of one-fourth per cent of the gross business transacted. There is consequently a considerable net financial gain to members through their membership in the Association. This is due to the efforts of the secretary in securing a better rate for liability insurance than has been offered through the regular channels of business. On the other hand, contractors who are not placing insurance through the Association are incurring financial loss.

A scheme of mutual insurance is contemplated by the National Electrical Contractors' Association, which will extend the benefits of co-operation to contractors all over the country, and will result in an additional saving to Illinois contractors of 30 per cent or more over the present rates.

The session on Saturday morning was opened by a talk by a representative of one of the tourists' agencies, who presented a plan for a special train to carry the Illinois contractors to San Francisco next summer.

William McGuineas explained what had been done by a committee of Chicago contractors which has been looking into the same question.

George B. Muldaur, representative of the Society for Electrical Development, then explained to the members of the Association the objects of this society, which is endeavoring to secure co-operation between the different electrical interests. Mr. Muldaur has made an extensive trip over the country, investigating conditions in all of the large cities especially. As an illustration of the difference in conditions in different parts of the country, he said that 98 per cent of the houses on the Pacific Coast are wired, whereas in New Orleans there are approximately 60,000 unwired houses to 2,000 wired. The Society now has nearly 1,300 members, of which over one-third are electrical contractors. Since the contractor comes in close contact with the public, much attention has been given to supplying the contractors with useful data. He also referred to the activity of the Society in general publicity work, which consists, among other things, in supplying newspapers and magazines with reading matter and in preparing motion-picture films. A letter was read from Mr. Edgell, who is in charge of the window-display service of the Society, and is supplying contractors with many valuable suggestions as to window dressing. The Society stands ready to render any service within its power to contractors whenever they may call upon it.

George W. Hill, representative of the National Electrical Contractors' Association, then made a stirring address in which he explained a new plan of organizing the work of the Association, which will result in the solicitation of every contractor in the country for membership, and will give a record of the status of all. This will be accomplished through the medium of state and district chairmen. He said the interest in Association work was being rapidly extended, as it was generally appreciated that co-operation is better than competition. He referred especially to the work done by him in New England during the past year. He pointed out that only 40 per cent of electrical contracting jobs are competitive at all, as was shown by actual statistics which had been collected on this subject.

Mr. Hill also referred to an accounting system for the electrical contractor which he has recently worked out, and which he hopes will be adopted by the National Association. A description of this system will be found upon another page.

The floor was then thrown open to the representatives of manufacturers, and brief addresses were made by H. D. Butler, of the National X-Ray Reflector Company, and by Louis Meissner, of the Edison Storage Battery Company.

At the session on Saturday afternoon further reports of committees were received. The question of a license law for Illinois came up, but it was decided not to push this matter at the present time.

Ernest Freeman made a report upon the meeting of manufacturers to consider concentric wiring, held in New York City in December, which he was requested to attend upon behalf of the electrical contractors. He made a brief statement of the sentiment expressed and the action taken by this meeting, which has been already reported in this journal. A motion was then adopted by the Association to go on record as opposed to the use of concentric wiring, on account of its being an inferior system.

The question of the rates secured by electrical contractors from central stations for current used in display fixtures was then thoroughly discussed, but no action taken.

Five new members were elected to the Association and it was unanimously voted to hold the next convention in Peoria. A vote of thanks to the Entertainment Committee was then passed for its excellent work in arranging the entertainment features of the convention. These consisted of a theater party for the visiting ladies on Friday evening and an entertainment and lunch for the members; and a banquet and entertainment for both members and ladies on Saturday evening.

This banquet was made the occasion for the festivities of the Electrical Contractors' Association of Chicago, which are usually held about this time of the year. R. C. Bierdemann acted as toastmaster, and called upon a number of those present to respond. The first of these was Secretary E. J. Burns, of the State Association, and he was followed by George W. Hill, Harry Russell, E. J. Ball, president of the State Association; Perry Boole, William McGuineas, W. A. Jackson, and Warren Orne, president-elect of the Chicago Association.

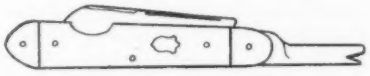
Ernest Freeman then delivered a presentation address on behalf of the Chicago Association, which presented a beautiful silver loving cup to its retiring president, Richard W. Poelma. Mr. Poelma made an appropriate response, showing the appreciation which he felt for the many words of praise which had been expressed by the previous speakers, and urging upon the members of the Association loyalty to their officers and co-operation in the attainment of the Association's objects.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Knife for Skinning Duplex.

The accompanying illustration shows a knife blade which has been ground



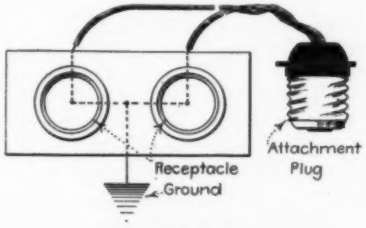
Knife for Skinning Duplex.

off square, and then had a V-shaped groove filed out of it. This is very handy for removing the outer casing from duplex wire.

W. W. Schnohr.

Grounds on Three-Phase Circuit.

In our plant we have localized lighting with a lamp at each loom, and as the weavers rest their lamps on the looms we often get grounds. In hunting for grounds it is not easy to telephone to the engineer on account of the noise and hand signals require extra help. I devised the ground de-



Ground Detector.

tector shown in the illustration, since we use a three-phase, three-wire system. Two cleat receptacles are wired in series and the terminals connected to an attachment plug. A ground wire is connected at the middle point, and attachment made to any convenient loom. When hunting a ground the plug is connected to a socket. If the ground is on one of the wires leading to this socket, one lamp will burn brightly and one will be dark. If the ground is on the third wire both lamps burn brightly. When the ground has been cleared both lamps burn a dull red, due to half voltage. This is a great help in clearing grounds. William T. Estlick.

Reamer for Wood.

Sometimes a bit of the right size is not handy for boring holes in wooden beams. In the case of half-inch conduit a three-quarter-inch bit may be used and the hole reamed out with the tool shown in the accompanying illus-

Reamer.

tration. It is made from a piece of conduit, the end being filed to the shape shown. The blades may be spread a little to cut better. Gustave Oman.

Can for Asphaltum Paint.

The local inspectors require that all electrical joints be painted with asphaltum, or other insulating paint, after being soldered and taped. It has always been more or less trouble to carry this paint to a job in convenient form for use without getting it smeared all over the wiring materials or tools. Moreover, it dries up quickly in an open can and the brush gets stiff after use, so that frequently the entire outfit is discarded and a fresh one taken to the next job. The paint does not go very far with such use.

To remedy this, we take an ordinary oil can, such as is used for lard oil on conduit jobs, preferably one with a large neck. Into the spout of this can we fasten a good bristle paint brush, whittling the handle of the brush until it can be driven into the spout of the oil can. The can is filled with paint and the spout screwed in place. It is then ready to be taken out on a job. The paint cannot dry up and it can be carried in the tool box without danger of spilling. John Bornholdt.

Leather Nail Heads for Knobs.

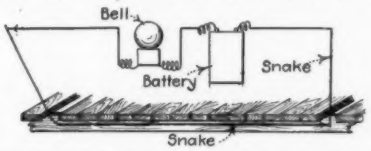
Get some scrap leather from harness shop, as most harness makers throw it

Making Leather Nail Heads.

away. Cut it into strips one-half inch wide or as large as the washers are to be. Pound the nails through the leather one-half inch or so apart by laying the leather on the jaws of a vise or a hole bored in the bench. Then cut in between the nail heads with a sharp knife. These nail heads can be made almost as fast this way as the ones procured in a supply house can be put on the nails. Carl L. Wanek.

Fishing Without a Helper.

When fishing wires I usually have a helper, who watches for the snake at the point where it is expected to appear. While alone on a recent job I used the following arrangement to avoid waiting for a helper. A short piece of snake was inserted at one pocket, and connected by wire to bat-

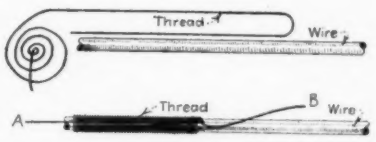


Snake in Position to Complete Bell Circuit.

tery and bell. A long snake was connected to the other binding post of the bell by a wire and fed in at the other pocket, as shown in the illustration. When it reaches the first pocket the two snakes make contact, ringing the bell. E. W. Gottschalk.

To Keep Insulation From Unraveling.

To keep insulation from bunching up on fixture or telephone wire, take a piece of strong thread and loop it as shown in the upper part of the illustration; then wind it tightly around the loop and wire together for about one inch, putting the end through the loop as shown in the lower illustration. Then pull end A tight while holding end B; then cut off both ends so that they do not show. With a little grease on the



Thread for Binding Insulation.

thread, fixture wire can be pulled in easily. For telephone wire and drop cords use silk thread of the same color as the insulation, and a neat job will result. Edward Kemp.

Another Way.

To prevent insulation from unraveling further than the bare wire is wanted, in the case of double-cotton-covered wire, do not cut the insulation off, but unravel to the desired point and tie the outer and inner layers in a knot, cutting off the loose ends.

To prevent paraffined insulation from slipping strike a match and apply a little heat to melt the paraffine.

P. Atherley.

Public Service Commissions

Conducted by William J. Norton

COLORADO.

M. H. Aylesworth has been appointed as the new member of the Public Utilities Commission, and Sheridan S. Kendall, senior member of the Public Utilities Commission, has been appointed chairman for one year. Mr. Kendall takes the place of A. P. Anderson, who has been chairman of the Commission during the past year. The services of a special attorney to advise with the Commission will be dispensed with and Mr. Aylesworth will serve in the capacity of legal adviser to the Commission.

IDAHO.

Overhead Line Construction. Representatives of the telephone, telegraph and power companies of the State have agreed upon a set of rules governing overhead construction of electric transmission lines and have submitted the rules to the Public Utility Commission.

Protection from Competition. Senator Thomas has introduced a bill in the State Legislature to repeal section 48 of the Public Utility Commission act which makes it necessary for public utilities to secure certicates of convenience and necessity before entering a new field. The bill aims to promote rather than restrict competition among public utilities of the state.

The Commission has a number of times passed upon the question of protecting an existing company which is rendering adequate service in a certain field from competition by a company proposing to furnish duplicate service. Among the important decisions are those dealing with the applications of the Idaho Power and Light Company and the Clear Lake Power & Improvement Company to enter the field now supplied by the Great Shoshone & Twin Falls Water Power Company; and the petition of the Beaver River Power Company to be allowed to compete with the Southern Idaho Power Company. The court has recently upheld the right of the Commission to render decisions refusing such applications for certificates of convenience and necessity.

MASSACHUSETTS.

New England Telephone & Telegraph Company. A bill has been introduced in the Massachusetts Legislature to provide for an investigation by the Public Service Commission of the New England Telephone & Telegraph Company and its relations with the American Telephone & Telegraph Company.

NEW YORK.

A bill has been introduced by Assemblyman Green of Kings, which is designed to consolidate the two Public Service Commissions into a nonpartisan commission of seven members. The Commission would consist of an electrical engineer, a civil engineer, a practical railroad engineer, two attorneys experienced respectively in corporation and financial law, and two business men. Three members of the proposed commission would be chosen from the political party casting the second highest number of votes at the last gubernatorial election. The terms of office would be reduced from five to two years.

Second District.

Annual Report. The Public Service Commission for the Second District has presented its report to the legislature for the year ending December 31, 1914.

Important changes in the Public Service Commissions Law are recommended to the legislature. These include the extension of the authority to suspend proposed rates, pending determination of their reasonableness, to the rates of telephone, telegraph, gas, electric and all corporations subject to rate regulation, in the manner provided last year in the case of common carriers in conformity with the Interstate Commerce Law.

It is recommended that the sale or transfer of telephone or telegraph properties and the acquisition of stock or bonds in one telephone or telegraph company by another be made subject to the approval of the Commission as are like transactions of other public service corporations, and that all telephone companies in the public service be subjected to regulation under the statute, instead of exempting those whose property is less than $10,000 in value.

Albany Municipal Gas Company. The Commission has decided that it would be unreasonable to order the Municipal Gas Company of Albany to supply all the kinds of current that might be needed by its consumers of electricity, and has dismissed the complaint of F. Ray Comstock, which asks that the company be directed to supply low-voltage direct current suitable for use with the "spot-light" on the stage. In the opinion written by Commissioner Irvine it is pointed out that the company does not refuse to supply several kinds of current, namely 500-volt direct current for power, and four kinds of alternating current for lighting and power. The company is willing to supply all of these standard kinds and sizes if the theater will install its own apparatus for transforming or stepping down the current to the kind or voltage it requires. If in response to this complaint, the company were to be compelled to install the special apparatus needed either at its plant thence to be transmitted over special lines, or on the premises, any consumer, desiring any special variation of current might compel the company to furnish it or else be subject to a charge of discrimination. This policy would obviously involve a ruinous duplication of plant and lines throughout the city.

The Afton-Windsor Light, Heat & Power Company was authorized to issue $35,000 of its 6-per-cent thirty-year gold mortgage bonds to be sold at not less than 90, for the further financing of new construction and for the purchase of additional equipment.

VIRGINIA.

The Virginia Railway and Power Company, operating in Richmond and Petersburg, has filed a new schedule of retail light and power rates with the State Corporation Commission, effective April 1, 1915. The new rates provide a substantial reduction in the rates of all consumers coming under this classification. The net rates for lighting are:

Nine cents per kilowatt-hour for the first 100 kilowatt-hours consumed per month; 6.3 cents for the next 150 kilowatt-hours; 4.5 cents for the next 450 kilowatt-hours; 3.6 cents for the next 1,500 kilowatt-hours; 3.15 cents for the next 7,800 kilowatt-hours; 2.502 cents for the next 10,000 kilowatt-hours; 2.007 cents for the next 15,000 kilowatt-

hours; 1.755 cents for the next 50,000 kilowatt-hours; 1.503 cents for all excess over 85,000 kilowatt-hours consumed per month.

The rates for power and incidental lighting where such lighting is 10 per cent or less of the power, are the retail lighting rates with 10 per cent discount. A reduction is also made in the minimum charge for power consumers over 5 horsepower, and for commercial light consumers over 5 kilowatts.

The Commission has not passed upon these rates, as the city has asked the Commission to institute a general investigation of the company's rates. A hearing has been held before the Commission, and unless the application is withdrawn, another hearing will be held February 16.

MANILA.

Manila Electric Railroad & Electric Light Company. The Manila Board of Public Utility Commissioners, in a decision rendered December 4, 1914, has upheld the practice of the company in refusing to collect in one monthly bill charges for electric current rendered to one consumer, but measured by several meters, located on separate properties belonging to one consumer. The decision says:

"Subscription to measured-current service is optional with the consumer, who is really benefited by it, because he is thus enabled to economize on the electric current, and it would be unreasonable to prevent the company from treating each meter measuring the electric current of an electric light installation as a consumer seeing that the meter is placed for the convenience and benefit of the consumer, and that the company would then be deprived of the minimum monthly charge, authorized as a just compensation for the gratuitous installation and use of the meter."

The decision further says:

"The fact that the four houses mentioned are in a group and serve the same purpose, i. e., the hotel business, is no reason why the several light installations, each with its respective meter, in the said houses should be considered as one consumer for the purposes of the contract, and consequently also for those of the greater discount and exemption from the minimum monthly charge per meter, because if said installations were so considered, it would constitute an unreasonable discrimination or preference in favor of the complainant, Mrs. Moffat, in charging for the service rendered as the charge would be the same as in the case of a consumer having only one meter for measuring the current consumed by him. Moreover, it would give rise to combinations, difficult to avoid, on the part of the consumers and to the detriment of the company, for the purpose of securing from the latter the largest accumulative discount possible in their respective electric light bills. . . .

"We may cite here the case of the City of Newark, in the State of New Jersey, United States, against two companies, one an electric light and the other a gas company, which case was decided by the Board of Public Utility Commissioners of the state mentioned, because, although the case is not identically the same as the one under consideration, yet the principle established can be applied here. Upon deciding said case, the Board said:

" 'The contention that the consumption of gas and electricity in all public buildings in the city of Newark should be treated as if furnished at one separate installation, thus enabling the city to get the benefit of a larger discount is, in the opinion of the Board, unreasonable and if granted would be in fact a discrimination in its favor unless the same rule applied to all owners of more than one piece of segregated property.' (City of Newark vs. Public Service Co., 77 Rep., Board of P. U. Comm., Vol. I, p. 413.)

"The Board therefore understands that the complaint filed by Mrs. Moffat can not be sustained, and the same is therefore dismissed."

European Boiler-Room Practice.

On January 13 William A. Blonck gave a lecture before the New York Electrical Society on "European Boiler-Room Practice and Boiler Efficiency Methods in the United States, with reference to Electric Light and Power Plants." Mr. Blonck opened his address by a short account of conditions which he found in Europe while recently taking a trip for the special purpose of investigating boiler practice on the European continent. This trip was abruptly terminated by the declaration of war, and after being detained in Germany and Holland for seven weeks, owing to lack of ocean transportation, Mr. Blonck returned to this country. He then described, with illustrations, large power-house design as seen in the central part of Germany, showing the architectural features as well as the coal-handling apparatus, and the arrangement of a very desirable installation in the way of connecting the turbogenerators with their auxiliaries. He went on to discuss the so-called unit power system in which the endeavor was made to bring the initial cost to a minimum, while bearing in mind that efficiency was kept as high as possible and maintenance as low as possible. In this system the main object to be attained is to get just the expenditure which is necessary for the requirements at the time being, and later add such units that each of them is an entity by itself.

The boilers operated in these various plants showed different features from those prevalent in the United States. It can be realized that if the gases leave the boiler, according to our custom, at 550 degrees, or somewhat lower, it will be noticed that the last part of the boiler does very little work in the evaporation of water into steam. Therefore, the last part acts more or less an an economizer. On the Continent they have utilized this fact by simply doing away with that part of heating surface presented by the last part of the boiler, and they have evolved a method by which they build right into the side walls of the boiler, an economizer of the same heating surface as the boiler proper. They then run in connection with such layout a so-called ejector draft, which consists of a short conical stack combined with a nozzle through which an air current is blown by a sirocco fan having a maximum capacity not exceeding 1.5 per cent of the boiler output. With such an arrangement the builders are able to cause a larger circulation and a greater evaporation per square foot of heating surface of the boiler. Due to the fact, however, that our steam pressures are rising continually, it is exceeding desirable to have our gases leaving the boiler at much lower temperature than 550 degrees. This is accomplished in the aforesaid design by the large heating surface in the economizer, with the addition of induced draft making up for the temperature difference which in the normal boiler produces sufficient draft to carry away the gases. With this arrangement they are able to exhaust the combustion gas at the stack with a temperature of 350 degrees, or somewhat higher. So that the combined efficiency of boiler, superheater and economizer ranges between 84 and 86 per cent.

One of the most interesting parts of Mr. Blonck's address was devoted to the consideration of increased boiler efficiency, and how to obtain it. The lecturer stated that very early in the art of designing boiler plants the electrical engineer insisted upon having a quantitative and qualitative analysis of the product in his plant.

In the boiler room where in most instances nothing but a steam gauge and a water glass are found, a waste of 20 to 25 per cent is very common, because so much guesswork prevails. It has therefore been the aim of the speaker to introduce methods which are exceedingly simple, and can be followed by the fireman, and by which greatly improved results can be obtained. (See ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, January 10, 1914.)

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 20.

When the field coils of a four-pole dynamo (see Fig. 19) are connected in series and carry a current of 8.7 amperes, the flux linked with each field coil is 13,200 kilolines. Assuming that each field coil contains 725 turns as obtained in Problem 18, find (*a*) the inductance of the field circuit; (*b*) the inductance of one field coil, and (*c*) the energy stored in the magnetic field of the dynamo. If a non-inductive resistance of 10,000 ohms is connected inside the field switch and in parallel with the field circuit, find (*d*) the potential drop in this resistance just after the field switch is opened.

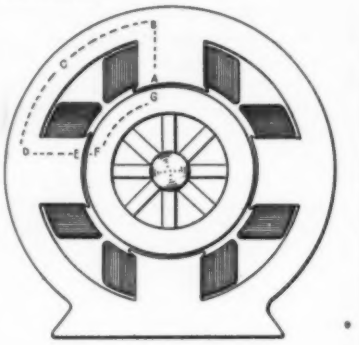


Fig. 19.

SOLUTION OF PROBLEM 20.

Answer to Question a.

If the magnetic circuit of a four-pole dynamo is rearranged as shown in Fig. 21 the operation of the machine is not changed and the relation of ampere-turns to flux is made more obvious. Considering first the upper left-hand magnetic circuit, the flux of 13,200 kilolines is produced by the combined ampere-turns of the two associated field coils. The inductance of this part of the field circuit is then given by

[34] $L=1{,}450\times 13{,}200{,}000\times 10^{-8}/8.7=22$ henries.

The inductance of the other half of the field circuit, given by the same calculation, also equals 22 henries. The inductance of two or more coils not wound on the same magnetic circuit is given by

[35] $L_0=L_1+L_2$, etc.

since the self-induced emfs. in each coil act independently of the others and are additive. The inductance of the field circuit by [35] is then

$L_0=22+22=44$ henries.

Answer to Question b.

If a current of 8.7 amperes is passed through but one of the field coils wound on either of the magnetic circuits the flux produced in that magnetic circuit will be approximately 13,200,000/2 or 6,600,000 lines. In either of the magnetic circuits shown in Fig. 21 most of the ampere-turns wound on the field cores are required to force the flux across the air-gaps. In the solution of Problem 18, for example, it was shown that 9,390/12,618 or 74.3 per cent of the ampere-turns were required to force the flux across the air-gaps. The flux in such a magnetic circuit will vary almost directly with the number of ampere-turns wound on the circuit.

Assuming then that a flux of 6,600,000 lines is produced by one field coil acting alone the inductance of that coil is given by [34].

$L=725\times 6{,}600{,}000\times 10^{-8}/8.7=5.5$ henries.

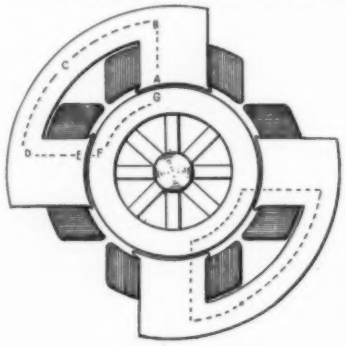


Fig. 21.

The inductance of one-half of any electric circuit wound on a magnetic circuit of constant length consisting entirely of air or containing a large air-gap is then not one-half but one-fourth of the total inductance. The general rule in such a case is that if the total inductance of N_0 turns is L_0 henries the inductance L_1 of N_1 turns equals $N_1^2L_0/N_0^2$. If the length of the magnetic circuit is changed when the number of turns is changed as in the case of a long straight solenoid the inductance varies directly as the number of turns.

Answer to Question c.

Since most of the ampere-turns are used up in the air-gaps the inductance of such a circuit will be very nearly constant independent of the current (see answers to Problem 19). When the inductance of any circuit is constant the energy stored in the magnetic field is given by

[36] $W=LI^2/2$ joules.

The energy stored in the magnetic field of the four-pole dynamo shown in Fig. 21 is then given by [36]

$W=44\times 8.7^2/2=1{,}664$ joules.

Answer to Question d.

One of the fundamental laws of physics is that energy in any form can not be changed instantaneously into some other form. The energy stored in a magnetic field for example can not be changed instantaneously into some other form of energy. Furthermore if the flux in any electromagnetic field is proportional to the ampere-turns producing it the energy stored in such a field must be proportional to the current as indicated by [36]. Hence it follows that the current flowing in such a circuit can not be changed instantaneously even though the emf. producing it be suddenly removed.

If the field switch of the dynamo under consideration is opened suddenly the current flowing in the field circuit must then be 8.7 amperes as before, and since the resistance of 10,000 ohms connected in parallel with the field circuit before the switch is opened is connected in series with the field circuit after the field switch is opened the current flowing in this resistance must also be 8.7 amperes. The potential drop in this resistance is then given by [4]

$V=8.7\times 10{,}000=87{,}000$ volts.

The sudden opening of the field switch or the disruption of a fuse in the field circuit of a dynamo is then followed by an increased potential difference between the ends of the field circuit. The magnitude of this potential difference depends upon the rapidity with which the field circuit may be opened and upon the resistance connected in parallel with the field circuit. If the field switch is opened quickly without drawing an arc and there is no other path provided for the field current the resulting potential difference may be sufficient to puncture the insulation of the field winding. To prevent this it is customary to connect a low resistance across the field circuit of a large dynamo before opening the field switch.

This high voltage is caused by the self-induced emf. in the field circuit as given by [33]. This self-induced emf. opposes the change in current as outlined in Problem 19 and although decreasing in magnitude continues to act until all of the energy stored in the magnetic field is converted into heat.

ALTERNATING CURRENTS.

Problem 70.

The three-phase alternator described in Problem 68 delivers its full-load current at the rated terminal voltage to an inductive load operating at a power-factor of 0.84. The temperature of the armature winding may be taken as 85 degrees centigrade. In the following calculations, use the magnetomotive force, or reaction, method and find the reaction of the armature in terms of field current from the open-circuit and zero-power-factor characteristics. (*a*) What is the necessary field current? (*b*) With the same field current, what will be the terminal voltage if the alternator full-load current has unit power-factor? (*c*) If this alternator delivers 4,000 kilowatts at the rated voltage to a condensive load operating at a power-factor of 0.90, what is the necessary field current? (*d*) What would be the open-circuit, or excitation, voltage if this load were removed?

SOLUTION TO PROBLEM 70.

Answer to Question a.

In Problem 69 the effective resistance per phase at 85 degrees centigrade was found to be

$$R_e = 0.0748 \text{ ohm.}$$

The field current necessary to produce the rated terminal voltage of 6,600 volts on open circuit is

$$I_f = 150 + 50\ (6600 - 6500)/(7400 - 6500)$$
$$= 156 \text{ amperes.}$$

At zero power-factor the field current necessary to produce the rated terminal voltage when the armature current is 438 amperes is 255 amperes. The reaction of the armature, or its equivalent magneto-

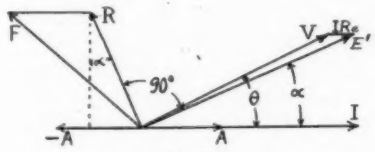


Fig. 22a.

motive force, in terms of field current, is:

$$A = 255 - 156$$
$$= 99 \text{ amperes.}$$

The vector diagram used in calculating the performance of an alternator by this method is given in Fig. 22a. V is the terminal voltage per phase and I is the armature current. Cos Θ is the power-factor which in this case is 0.84. R is the field current which would produce an open-circuit phase voltage equal to E', and it is drawn 90 degrees ahead of this voltage. A is the total reaction of the armature and is drawn in the same direction as the armature current. Two methods of obtaining it were described in Problem 68. In this case it is 99 amperes. F is the necessary field current and is found by adding R and $-A$ vectorially.

From Problem 69 the terminal voltage per phase is

$$V = 3810 \text{ volts.}$$

The full-load current per phase is

$$I = 438 \text{ amperes.}$$
$$IR_e = 32.8 \text{ volts.}$$

The horizontal component of the terminal voltage is

$$V_h = 3200$$

The vertical component of the terminal voltage is

$$V_v = 2065$$

By [19a] $E'_h = 3200 + 32.8$
$= 3233$

and $E'_v = 2065 + 0$
$= 2065$

By [20a] $E' = \sqrt{3233^2 + 2065^2}$
$= 3837$ volts.

This is a phase voltage. Before looking up the field current which would produce it on open circuit it must be multiplied by the square root of three. This gives:

$$3837 \times \sqrt{3} = 6645$$

The field current corresponding to this open-circuit voltage is

$$I_f = 150 + 50\ (6645 - 6500)/(7400 - 6500)$$
$$= 158 \text{ amperes.}$$

The value of the vector, R, in the diagram is thus 158 amperes. Since R is perpendicular to E' the angle, α, that it makes with a vertical line is the same as the angle that E' makes with the horizontal. For this reason the value of R and its horizontal and vertical components are all in the same proportion to the value of E' and its vertical and horizontal components. The horizontal component of R is

$$R_h = 158 \times 2065/3837$$
$$= -85$$

The minus sign is used since it is drawn toward the left instead of toward the right.

The vertical component of R is

$$R_v = 158 \times 3233/3837$$
$$= 133$$

By [19a] $F_h = -85 - 99$
$= -184$

and $F_v = 133 + 0$
$= 133$

By [20a] $F = \sqrt{(-184)^2 + 133^2}$
$= 227$

The necessary field current calculated by this method is 227 amperes. Compare this with the value of 206 amperes obtained for the same load conditions by using the synchronous reactance. The actual value of the field current is probably somewhere between these two. If, for example, it were half way between, the error in each would be about five per cent. In most cases the error would probably be less than this. These results bring out the important point that the methods used are not exact ones and may be expected to give only approximate solutions.

Answer to Question b.

The vector diagram is given in Fig. 23a. The values of F, A and I are unchanged. The terminal voltage per phase, V, is unknown in magnitude but it is in phase with the current since the power-

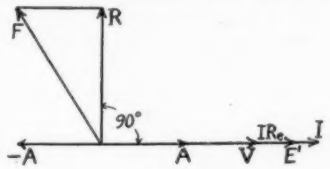


Fig. 23a.

factor is unity. In this case R is perpendicular to A so that

$$R = \sqrt{F^2 - A^2}$$
$$= \sqrt{227^2 - 99^2}$$
$$= 204 \text{ amperes.}$$

The open-circuit terminal voltage corresponding to this field current is

$$\sqrt{3}E' = 7400 + 550 \times 4/55$$
$$= 7440 \text{ volts.}$$
$$E' = 4295 \text{ volts.}$$

The terminal voltage, V, per phase is

$$V = E' - IR_e$$
$$= 4295 - 33$$
$$= 4262$$

The terminal voltage is

$$4262\ \sqrt{3} = 7380 \text{ volts.}$$

Compare this with the value of 7270 volts found in Problem 69.

Answer to Question c.

The vector diagram is given in Fig. 24a. As in Problem 69 the current is 389 amperes and

$$IR_e = 29$$
$$V_h = 3430$$
$$V_v = -1660$$

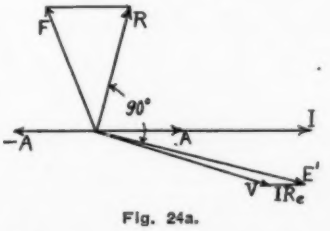


Fig. 24a.

The horizontal and vertical components of E' are

$$E'_h = 3430 + 29$$
$$= 3459$$
$$E'_v = -1660$$
$$E' = \sqrt{3459^2 + (-1660)^2}$$
$$= 3837 \text{ volts.}$$

The corresponding terminal voltage is $3837\ \sqrt{3}$ or 6640 volts.

The field current which will produce this open-circuit voltage is

$$R = 150 + 140 \times 50/900$$
$$= 158 \text{ amperes.}$$

As in **Question a:**

$$R_h = 158 \times 1660/3837$$
$$= 68$$
$$R_v = 158 \times 3459/3837$$
$$= 142$$

By [19a] $F_h = 68 - 99$
$$= -31$$
$$F_v = 142$$

By [20a] $F = \sqrt{(-31)^2 + 142^2}$
$$= 145 \text{ amperes.}$$

Compare this with the value of 142 amperes obtained in Problem 69. In this case the agreement is very close.

Answer to Question d.

The open-circuit or excitation voltage corresponding to this field current is

$$4800 + 1700 \times 45/50$$
$$= 6330 \text{ volts.}$$

Roebling's Insulated Wire Plant Destroyed by Fire.

Fire destroyed the insulated wire plant of John A. Roebling's Sons Company at Trenton, N. J., on the evening of January 18. The fire, which is believed to be of incendiary origin, caused a loss to the concern estimated at $1,000,000, of which $700,000 is said to be covered by insurance.

Ferdinand W. Roebling, Sr., general manager of the company, said the plant would be rebuilt at Trenton. The company is one of the most progressive manufacturers of wire and cable specialties in the world, and has been associated with many noteworthy engineering enterprises in every part of the globe.

Only English Spoken in British Guiana.

Recent advices from British Guiana call attention to the fact that this is a British colony and only English is spoken there. The complaint is made that business men receive in nearly every mail a large quantity of Spanish correspondence, which generally finds its way into the waste-paper basket, and it is doubted whether there are two offices in Georgetown, British Guiana, particularly, which have any correspondence in Spanish.

Large Increase in 1914 Production of Oil.

The phenomenal increase which has characterized the growth of the petroleum industry in the United States during the last 8 years was more than maintained in 1914. The amount of petroleum produced in the last 12 months approximated 292,000,000 barrels, according to estimates of John D. Northrop of the United States Geological Survey. These preliminary figures indicate an increase of more than 13 per cent over the production in 1913.

DIRECT CURRENTS.

Problem 21.

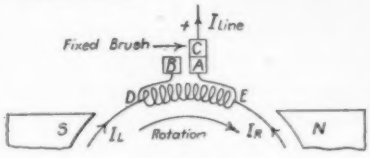


Fig. 22.

In Fig. 22 are shown parts of the armature, commutator and pole-pieces of a 10-kilowatt, 100-volt bipolar direct-current separately excited generator. The armature rotates at a constant speed of 1,200 revolutions per minute in a clockwise direction and the commutator contains 50 segments. The armature turns connected to the segments A and B of the commutator are shown diagrammatically by the coil connected between D and E. The inductance of the armature turns D E is 0.00003 henry and is to be assumed constant. Find the rotational emf. which must exist in the turns D E in order that the current in D E may reverse uniformly during the commutation period (a) at half-load and (b) at full-load.

This problem illustrates the conditions required for sparkless commutation in a direct-current generator.

ALTERNATING CURRENTS.

Problem 71.

In regard to the three-phase, 5,000-kilovolt-ampere, 6,600-volt alternator, which was described in Problem 68, the following additional data are given. The resistance of the field circuit at a temperature of 25 degrees centigrade is 0.549 ohm. The friction and windage loss is 38 kilowatts. The core losses for different values of open-circuit terminal voltage are as follows:

Field Current in Amperes	Terminal Voltage on Open-circuit	Core Loss in Kilowatt-hours
100	4800	45
135	6000	73
155	6600	90
210	7500	123
255	7950	...

Take the temperature of both the field and armature windings as 85 degrees centigrade. At this temperature the effective resistance of the armature winding per phase is 0.0747 ohm. The synchronous reactance calculated by using the zero-power-factor curve is 1.78 ohms per phase. The methods of calculating these values were given in Problem 68. It should be remembered that the armature windings of this generator are connected in star.

(a) What is the efficiency of this alternator when it delivers one-half its rated load at unit power-factor? (b) What is its efficiency when it delivers its rated load at unit power-factor? (c) What is its efficiency when it delivers full-load current to an inductive load which is operating at a power-factor of 0.84? (d) How much power is required to drive this alternator on open circuit when the terminal voltage is 6,600? (e) How much power is required to drive this alternator on short-circuit when the armature current is 2.5 times its full-load value? (Assume that the temperature of the winding is 25 degrees centigrade.) (f) How much power is required to drive this alternator when taking the so-called zero-power-factor characteristic if the armature current has its full-load value, the actual power-factor is 0.05 and the terminal voltage has its rated value? Assume that the temperature of the armature is 25 degrees centigrade.

This problem illustrates the methods of calculating the efficiency of an alternator.

Solutions of the above problems and two new problems will be printed in the next issue.

EXPORT TRADE AND HOW TO GET IT.—III.

By G. F. Bagge-Féron.

Latina-American Trade for 1913.

In many recent discussions dealing with the cultivation of American foreign trade, it has been stated that, in order to get other countries to buy our products, we must also be willing to buy their products. This is a perfectly fair reciprocal relation. Let us see what is the situation in this regard between the United States and the Latin-American countries south of us. These include Cuba, Dominican Republic, Mexico, Central America and the ten South American republics, or in all 20 different governments. It may therefore be of interest to have an insight as to where Latin-America's products go, and what proportion is shipped to the United States.

According to statistics of exports during the year 1913, the following table shows where Latin-American products went:

Shipped to	Value in Gold
United States	$504,378,212
Great Britain	316,419,914
Germany	192,394,702
France	120,917,415
Belgium	62,557,566
Holland	43,277,631
Italy	27,964,001
Austria-Hungary	23,294,991
All other countries together	247,722,380

This proves that the United States is in fact the very best customer of Latin-America, for which reason the reciprocal paying for United States products should not be so hard, if the natives only get to know from whom to get their needs supplied on reasonable terms.

The importation of foreign goods into Latin-America during 1913 has been computed as follows:

Imported from	Total Value in Gold
Great Britain	$322,036,347
United States	317,323,294
Germany	216,010,418
France	103,220,223
Italy	55,494,413
Belgium	48,747,164
Austria-Hungary	99,026,478
Holland	6,189,050
All other countries	217,290,511

In 1913 the total exports from Latin-American countries amounted to $1,565,916,812; in 1913 the total imports to Latin-America were $1,304,261,736; thus there was produced a balance in their favor of $261,655,076, a very handsome figure.

The total exports from Germany during 1912 to the South American countries and their supplementary imports from other countries were as follows:

Shipped to	Value in Gold Dollars
Argentina	$62,000,000
Brazil	53,000,000
Chile	33,000,000
Bolivia	6,400,000
Colombia	4,200,000
Ecuador	1,500,000
Ecuador—imported from other countries	$9,000,000
Paraguay	1,500,000
Paraguay—imported from other countries	3,500,000
Peru	4,500,000
Peru—imported from other countries	20,500,000
Uruguay	7,900,000
Uruguay—imported from other countries	38,600,000
Venezuela	3,200,000

The exports of electrical goods from Germany in 1912 were:

To Argentina	
Dynamos and motors	$1,213,000
Wire and cables	1,228,000
To Brazil	
Electrical machinery and supplies	$1,550,000
Copper wire and cables	285,000

Electrical Activity in Argentina.

The preceding article gave some data on the electrical development of Argentina. That country had by the end of 1913, 670 miles of electric trolley-car tracks, whereof 467 miles was in Buenos Aires alone. The passenger traffic on these lines amounted to 423,661,587 passengers for 1913, or 31,000,000 more than in 1912.

Another proof of the activity in the electrical field of the Argentine Republic is seen in the following figures, which show in detail what was imported during the year 1913. The values are given in gold:

Electrical Imports	Value
Arc lamps	$ 233,000
Batteries (storage)	27,000
Batteries (material for same)	108,000
Cables and wires	4,900,000
Dynamos and large motors	1,127,000
Electric-light carbons	138,000
Fuses	42,000
Incandescent lamps	495,000
Instruments (ammeters, voltmeters, etc.)	33,000
Insulators	124,000
Insulating material (loom)	45,000
Insulating material (tubes)	314,000
Interrupters	111,000
Meters	712,000
Motors (small sizes)	91,000
Portable electric lamps	62,000
Telegraph apparatus	45,000
Telephone apparatus	95,000
Telephone parts	58,000
Underground accessories	168,000
Unclassified material and accessories	782,000
Ventilators, fans	92,000

The above figures showed a great increase of the imports of electrical material over 1912.

In 1913 the city of Buenos Aires entered into an agreement with the Compania Transatlantica de Electricidad of Buenos Aires for the latter to renew a part of the supply to the municipality of energy for the period of 15 years at a price of 4.3 cents (gold value) per kilowatt-hour. After this period the entire installation and material is to become the property of the municipality.

Electric Plants in Brazil.

The principal plant in operation in Brazil is to be found about 50 miles from the capital, Rio de Janeiro. From an artificial lake on the River Lages the energy of a hydroelectric power plant is transmitted to the city by two separate steel tower lines at 88 kilovolts, each line carrying 9,000 horsepower; in emergency either line can take 18,000 horsepower. From the terminal substation in the city the energy is carried to 15 distribution centers at 6,300 volts, the latter for the most consisting of street vaults. The supply is polyphase current, 50 cycles for lighting service at 120 volts (star tension to neutral) and for motors at 208 volts (star connection). The plant has operated since 1908 and is owned by the Rio de Janeiro Tramway, Light & Power Company. Total capacity is 40,000 horsepower with a later addition of 60,000 horsepower from Rios do Pirahy and Parahyha, 100 miles from the city.

As a second to this is the plant in the city of Sao Paolo, operated by the Sao Paolo Tramway & Light Company, where the distribution current is polyphase, 60 cycles, for power and single phase, 125 volts for light.

Other Brazilian distributing companies are as follows:

Bahia (or San Salvador) Bahia Electric Light & Power Company.

Belem (or Para), Para Electric Railway & Lighting Company, distribution at 50 cycles, single phase.

Braganza, Companhia Paulista de Electricidade, distribution single phase, 50 cycles. 200 volts.

Franca, Companhia Francana de Electricidade, distribution polyphase, 50 cycles.

Limeira, Companhia Paulista de Electricidade, distribution polyphase, 60 cycles.

Maceio, Nova Empreza Luz Electrica, steam plant, single phase, 100 cycles, 2,000 and 1,000/100 volts.

Manaos, Manaos Tramway & Light Company, Limited, distribution direct current, 220 volts.

Picaccaba, Southern Brazil Electric Company, distribution polyphase, 50 cycles.

Ribeirao, Rufino de Almeida & Companhia, distribution polyphase, 50 cycles.

San Jose, Empreza de Agua, Luz & Energia Electrica de Florianapolis (or Desterro), distribution polyphase, 50 cycles.

At Blumenau not long ago proceedings were instituted for the erection of a hydroelectric plant on the river Salto, to furnish energy for light and power to the colony, besides the actual existing public lighting.

A recent note in a foreign paper stated that R. Ribeiro, of Rio de Janeiro, has submitted for a concession for building (without subvention) a high-speed electric railway to Santos. This would, in connection with the Sao Paolo Railway, reduce the duration of the trip from Rio to Sao Paolo by half.

At Estreito (Providence of Santa Catharina) the government has recently closed a contract with the bank-

ing firm of L. Dreyfus & Company, of Paris, France, for the building of an electric narrow-gauge railway to Lages, which contract the national congress before had sanctioned.

Anglo-Brazilian Power & Shipping Corporation, Limited, was formed in London in 1911, with the object of undertaking power and other projects in South America and elsewhere, outside the United Kingdom. Horacio P. Vieira, of Purana, Brazil, is one of the principal shareholders. The authorized capital is £3,000,000.

At San Luiz (or Maranhao) a concession for electrical energy exploitation has been obtained by Domingos Barros & Companhia, of Natal.

Electrical Developments in Chile.

One of the most important electric systems in Chile is that centering at Santiago and operated by the Chilian Electric Tramway & Light Company. It has a hydroelectric plant at San Tuan de Pirgue on the Rio Maipo. Its total capacity is about 60,000 horsepower. Polyphase current is generated at 50 cycles, 12,000 volts and transmitted to converter substations in the city of Santiago, this distribution being direct current, 220 volts.

The South American Railless Traction Company has obtained a concession for ten years for operating a service of electric omnibuses in Santiago. There is prospect for the electrification of the railway line to Punto Alto. Other projects are pending for Valparaiso, San Antonio, Constitucion, etc.

At Antafogasta, the Compania de Electricidad distributes direct current at 220 volts. At La Serena, the Compania de Luz Electrica, also distributes direct current at 220 volts.

The Chile Exploration Company, of Santiago, has an important electrical installation for producing copper in the electrolytic way direct from the ore. The plant was built by a German firm. The steam generating station is at Tocopilla on the coast and is equipped with fuel-oil-burning boilers and 50-cycle, 5,000-volt, 10,000-kilovolt-ampere polyphase turbogenerators. From the step up transformers, 30,000 kilowatts is carred at 110 kilovolts to the mine substation 87 miles inland and 9,000 feet up in the mountain to the place known as Chupuicamata. Here the energy is converted to direct current, 235 volts, by seven rotary converters rated 2,500 kilowatts each. It is intended later to build a hydroelectric power plant on the Rio Loa, nearer to the mine. The charactertistic feature of this plant is that the entire energy is used for producing copper direct from the ore by an electrolytic process; for each 24-hour day for handling of 10,000 tons of ore the electricity used is about 60,000 to 70,000 amperes at 235 volts.

Peru.

At Lima, in Peru, the Associated Railway, Light & Power Company operates the trolley line between Callao and Lima, and has also central stations in Chosica and Santa Rosa, on the Rimac River. In the city of Lima there are two companies furnishing energy for light, the one referred to above going under the native firm name of Empresas Electricas Associadas, and the other is the Empresas Electricas de Santa Rosa. Further there is the Cerro de Pasco Compania, which has two rivers to exploit, 30 and 50 miles from the capital.

At Cuzco, the Sociedad Electrica del Cuzco Limitada furnishes light and power.

The Compania de Tranvia Electrica de Arequipa has a power house in Charcani, near the city of Arequipa, and furnishes light and power. The capital of the company is $1,500,000.

Peru has at present eight radiotelegraphic plants, which proves that the country is going forward and is rapidly becoming up to date. There are in the country 26 rivers where hydroelectric power will doubtless find development in the future.

Bolivia.

In spite of the fact that the republic of Bolivia has no connection with the sea coast directly, it is noteworthy that the importation of electrical goods amounted in 1913 to nearly $400,000. The ports used for shipping goods are Arica and Antafogasta, from which single-track railroads lead over the Andes Mountains at an altitude of more than two miles. The capital city, La Paz, has electric light and trolley service. The Corocoro mining district is under development as well as the Oruro mines and the electrical industry is destined to be lively. As far as the city Riberalta, in the northern regions, there is discussed the question of installing electric light, since candles and kerosene are very expensive. From La Paz leads a railway through the Yungos regions to the navigable waters of the river Beni, which is making the northern cities grow fast.

Ecuador.

The Empresa de Luz y Fuerza Electrica, of Guayaquil, has a hydroelectric power plant in Bucay on the Rio Chimbo, about 53 miles from Guayaquil. This station has Francis turbines with polyphase generators, 42 cycles, 800 volts. The transmission line operates at 40 kilovolts from step-up oil transformers and runs to the substation at Recreo. Distribution is at 3,200/110 volts single phase, and for trolley service direct current, 550 volts supplied from rotary converters. Future supply of current for industrial use will require important extensions, as also will the furnishing of energy for the street-car system in the capital, Quito.

Loja, a city in the southern part of the republic, may have today an electric light plant, as some time ago it was considered to take up a loan for 30,000 sucres for its construction.

Colombia.

At Bogota, the Compania de Energia Electrica de Bogota, supplies power from a hydroelectric plant at Charquito, about 16 miles from Bogota, on the river of the same name. The transmission line carries 20,000-volt, polyphase, 60-cycle current; the secondary distribution is at 260 volts, either single phase or polyphase, from the seven substations. Energy is also furnished to the Bogota City Railroad Company.

At Cartagena, the Compania de Luz Electrica, has a fairly large plant.

There are many smaller central stations all over the country, as follows:

Medellin, main center of the important department of Antioquia.

Girardot, end point of navigation on the Magdalena River and near Bogota.

Zipaquira, on the north railroad line to the State salt mines.

Cali, Bucaramanga, Manizales, Barranquilla, Jbaque, Santa Marta, Tunja, etc.

Aside from probable extensions to these plants, another reason for future development is seen in the existence of immense coal beds along the waters of the Sinu River in the northern part of the republic, west from Cartagena, which are still unexplored and unexploited. Their richness is said to rival that of the western part of Pennsylvania.

Venezuela.

Among electrical developments in Venezuela may be mentioned the following:

At La Guaira, the Compania Generadora de Fuerza y Luz Electrica is exploiting the Mamo Falls.

At Caracas the Compania Anonima Tranvias Electricas has operated trolley service since 1908.

At Maracaibo the Compania de Luz Electrica distributes single-phase current at 125 cycles.

At Cavaes the Compania La Electricidad de Cavaes has a polyphase distribution at 50 cycles.

Uruguay.

The development of the electrical industry in Uruguay dates back as far as 1895, when the first plant was erected by Ganz & Company, of Budapest, Hungary, for the city of Montevideo. Modernization and extension has been continual since for public and private lighting and trolley service. The government has also a plant where polyphase current with a frequency of 50 cycles is used.

In 1909 the cities of Carmelo and

Villa del Rosario decided to build an electric light station for public and private lighting. At the end of 1912 the Senate passed the law for governmental control of electric power and with the prospect that the State would build power houses in the following 14 cities: Las Piedras, Pardo, Punta del Este, Maldonado, San Carlos, Santa Lucia, Canelones, Rosario, Dolores, Nico, Perez, Sarandi del Yi, Treinta y Tres, San Fructuoso, San Ergenio.

Another project for the exploitation of the Uruguay River by Salto and Paysandu, was under consideration in 1913 with the possible supply of energy to the Argentine side across the river.

Guatemala.

At Guatemala City, the Empresa Electrica del Norte y Sur has single-phase distribution at 60 cycles, 125 volts.

In Quezaltenango, the city had under consideration the erection of a power plant. For trolley-car service it passed a concession in 1911.

Dominican Republic.

At Santiago, William Lithgow has in connection with Foasted Engineering Corporation, New York (17 Madison Avenue), and Boston (88 Broad Street), a power concession for exploitation of the river Yaqui del Norte, capable of generating 6,000 horsepower to furnish energy to the following cities: Puerto Plata, Santiago de los Caballeros, Moca, San Francisco de Macoris, La Vega.

The city of San Pedro de Macoris not long ago closed a contract for the erection of a new central station.

At Santo Domingo the government of the Dominican Republic has accorded the concession for the exploitation of the water powers of the river Jza (San Christobal) for electrical purpose; the energy to be used for light and trolley-car service in the capital, as well as for other industrial purposes.

Haiti Republic.

In Port au Prince the Societe Hatienne de Force Motrice owns a hydroelectric plant 6.2 miles from the city and operates also a new electric railroad to Petionville, at 350 meters altitude, besides furnishing energy to Furcy, 1,700 meters higher up; also to other places, as: Jeremie, Las Cayes, Port de Paix, St. Marc, Jacmel.

At Port au Prince also the Societe d'Eclairage Electrique (G. Keitel & Company) operates trolley cars to Carrefour and supplies energy for light to the city, as well as to Cape Haitien, Gonaives.

Cuba.

At Havana the Havana Electric Railway, Light & Power Company uses generation and transmission voltages of 19,000 and 2,300 and the distribution for light is 115 and 230 volts, and for motors polyphase 230 volts and 60 cycles.

Other places in the province of Havana that use electric light are: Bainao, Carabello, Catalina de Guines, Jaruco, Madrugo, Rio Blanco del Norte, San Antonio and San Nicolas.

In Matanzas the Sociedad Anonima de Tranvias de Matanzas has a concession to operate street railway, which is supplementary to the central station built in 1908 for light, etc. Other places that have electric light in this province are: Caliente, Jovellanos, Monguito and Amarillos.

In Cienfuegos E. Montalvo obtained a concession for exploiting the Rio Jabacoa, from the municipality of Rodas (province of Santa Clara), for producing electrical energy for light and power. Other places in this province having accorded concession for electric stations are Los Arbos and Isabella de Sagua.

At Artemisia, province Pinar del Rio, B. Martinez has obtained a concession for erecting a light plant.

At Manzanillo (Oriente) the Manzanillo Water & Light Company has an electric central station.

The city of Moron, in Camaguey, gave out a concession for an electric light plant recently.

Mexico.

Mexican Light & Power Company operates a hydroelectric power plant at Necaxa, 125 miles from Mexico City. Voltages used are 88,000 and 20,000/3,000, polyphase 50 cycles. Distribution is (for light) 120 volts, single-phase and (for motors) 210 volts, polyphase. Besides there are many other plants in operation all over the country, data on which can be found in the electrical trade directories readily available in the United States.

In the above enumeration of plants to be found in the various Latin-American countries, no attempt was made to be complete, but rather to cite the principal, or at least typical plants, and to give some idea of the nature and state of electrical development to be found.

From the foregoing data it is noticeable that for lighting 220 volts is more frequent than 110 or 125, which circumstance makes it fairly easy for the manufacturer of appliances of all kinds to produce standard types. Wiring is generally made exposed on knobs and cleats.

The installation of all kinds of machinery may properly be characterized as one of the future great industries, not only in the coast cities of Latin America, but also in the interior. Natural resources exist in almost unlimited quantities in the waters of the Andes. There is hydroelectric power capable of indefinite development, differing only in different regions. This power already is utilized to a limited degree, and the places mentioned are not to be considered as a complete list of same. It covers only about 150 localities. There are many others that already have electric light, but there are innumerable other cities where it is still to be introduced.

Plants in the cities mentioned, however, are capable of great extension, and will need every kind of electrical material, and will, therefore, produce a good field for any maker of electrical goods, big or small.

When using the mail or parcel post it is of exceedingly great importance to watch carefully the postage, so that the same is ample, and not leave this point entirely in the hands of the office boy, who is more than apt to make mistakes, which will have far-reaching consequences in making bad impressions. According to the United States Official Postal Guide, parcel post is admitted to the following countries: Bolivia, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Mexico, Peru, Uruguay, Venezuela and Brazil. (Argentina is excepted.) To Brazil sendings are only accepted to the following cities:

Town.	State.
Bahia.	Bahia.
Bele Horizonte.	Minas Geraes.
Curityba,	Parana.
Para (Belem).	Para.
Pernambuco (Recife).	Pernambuco.
Rio de Janeiro.	Federal District.
Sao Paolo.	Sao Paolo.

To other places in Brazil sendings will be accepted only with the mark "Sender's Risk," or if sender notifies addressee by mail to call for same at the (to him) nearest city named, or marked "Delivery Arranged" when the buyer or addressee has arranged accordingly beforehand.

The size admitted is for all the same, except Colombia, and the maximum weight is 11 pounds, at 12 cents per pound.

In Venezuela and Brazil much American material is in use, and the Edison medium screw base is common. Where Ediswan or bayonet base is in use an adapter sometimes is best, as well as the thread-reducing nipple for lamp sockets. In the smaller cities the electric light company carries a stock of fixtures besides lamps, etc.

When addressing literature to a place where the company's name is not given, same can be sent to "El Gerente del Compania de Luz Electrica," or to "La Gerencia," which means the manager, management, or direction, respectively.

What to Do.

Select a few young men from your office force and tell them to get acquainted with Spanish, either by the Berlitz method, or by boarding with

a Spanish-speaking family, otherwise get the proper help from people who know the language. Enter an advertisement in some of the export papers with Spanish circulation. There are quite a few, such as:

America Commercial, Philadelphia, Pa.

Revista International Dun, New York City.

El Comercio, New York City.

Exportador Americano, New York City.

La Hacienda, Buffalo, N. Y.

America y Industrias Americana, New York City.

It is best to put in the advertisement in the issues for February, May, August and November, as these are the months of greatest activity and bring the best returns.

Their circulation varies from 10,000 to 30,000. However, as these papers have comparatively little touch with the electrical industry, direct propaganda by mail is undoubtedly most effective. Still nearly every house handling machinery does also include electric machinery, as motors, etc. Supplies are very often imported by the various electrical contractors direct and machine-importing firms do a great deal of installation of private plants of every description.

Western Red Cedar Men Meet.

The ninth annual meeting of the Western Red Cedar Association, formerly the Idaho Cedarmen's Association, was called to order at 11:00 a. m., on Monday, January 11, 1915, in the offices of The Lindsley Brothers Company, in Spokane, Wash., by President Flannery. Representatives of the following companies were present: B. J. Carney & Company, E. T. Chapin Company, Humbird Lumber Company, Lindsley Brothers Company, Lost Creek Cedar Company, National Pole Company, Northern Mercantile Company, Sandpoint Lumber & Pole Company, The Valentine-Clark Company, Western Lumber & Pole Company, *American Lumberman.*

After the reading and approval of the minutes of the last annual meeting, President Flannery presented his address, in which he referred to the sudden death of J. W. Benham, of Chicago, president of the Northern White Cedar Association, who was killed in an automobile accident last July.

The Piling Committee convened at the conclusion of the last annual meeting and adopted specifications covering cedar piling, which were approved by the Board of Directors and since that time have been universally adopted. The National Electric Light Association included specifications on western red-cedar poles in its new handbook.

"While consoling ourselves with having weathered a rather severe year, we can in truth contemplate with satisfaction the fact that industrial expansion not accomplished in the past will be projected in the future. Specifically, we face three factors which bear vitally on this assumption of better times. They are (1) the inauguration of the regional banking system; (2) the enormous amount of domestic capital now idle in the banks which is waiting for investment at the proper time; (3) and above all, the final analysis of the European war situation, which means that this country is due to become the work shop of the world.

"Your president believes that putting into operation the regional banking system will place funds at the disposal of constructive corporations and thereby stimulate our business by reason of its power to concentrate at the needed point the required credit. Your president, moreover, believes that the millions of investable capital now in the banks throughout the nation will make bond flotations possible, which in turn, will bring business to us. You have as a concrete example the resumption of the electrification of one of our transcontinental railroads, which distinctly indicates the sentiment of financiers in this regard.

"Lastly, your president is convinced that America is to be the provider, storehouse and the center of commercial activity for the world. The destruction in Europe is creating a vacuum which must be filled, and filled by the products of our industry. We cedarmen are the side partners of industry and with prosperity in all big business we will most certainly realize the same ourselves."

The election of officers resulted in the selection of W. M. Leavitt, of the National Pole Company, president; E. T. Chapin, of Spokane, vice-president; G. C. McDonald, of the Western Lumber & Pole Company, H. C. Culver, of the Sandpoint Lumber & Pole Company and W. M. Burns, of the Northern Mercantile Company, directors. The directors announced the re-appointment of R. L. Bayne as secretary-treasurer. The following committees were appointed:

Committee on Railroads: C. P. Lindsley, T. J. Humbird, H. C. Culver.

Committee on Poles: E. A. Lindsley, W. P. Flannery, G. C. McDonald.

Committee on Official Inspection: C. P. Lindsley, E. L. Clark, R. G. Jones.

Committee on Posts: F. C. Culver, L. D. McFarland, John A. Humbird.

Committee on Piling: E. T. Chapin, F. C. Culver, M. P. Flannery.

E. M. Fronk, traffic manager of the Western Pine Manufacturers' Association, spoke to the Association regarding the new rate book just issued by his department and the other services connected with the Traffic Department.

The members then adjourned to the Davenport Hotel for lunch. After several musical numbers, C. P. Lindsley as toastmaster called on T. J. Humbird, president of the Humbird Lumber Company and vice-president of the Old National Bank of Spokane, to speak on the financial situation. Mr. Humbird gave a very interesting talk on the subject, explaining in detail the new banking system and what might be expected from it.

H. C. Culver, president of the Sandpoint Lumber & Pole Company, and director of the Spokane & Eastern Trust Company, who had recently returned from a trip through the East, gave his impressions of what might be expected from that part of the country during the coming year.

C. P. Lindsley then spoke on the future of the cedar-pole industry. Mr. Lindsley cited the case of the great saving effected by the electrification of the Butte, Anaconda & Pacific Railway, which in one year's operation had effected a saving of over 20 per cent in operating costs alone, and a total saving of over 36 per cent. The Chicago, Milwaukee & St. Paul Railway expects to make a similar saving by the electrification of its mountain divisions. Mr. Lindsley claimed that if a saving of this sort could be made, it would be but a question of time until the other steam roads adopted electricity for motive power. As no pole has been discovered which can take the place of cedar, he claimed the Western red-cedar industry still had a big future. Mr. Lindsley also insisted that to secure the benefits of this, it would be necessary for all the dealers to co-operate to urge the use of the Western red-cedar pole and to work for the industry as a whole rather than for individual advantage.

On motion by Mr. Culver, the directors were instructed to take such means as they saw fit to advertise the advantage of the Western red-cedar poles to the trade, particularly in the Atlantic States.

American Institute News.

At the January meeting of the Board of Directors of the American Institute of Electrical Engineers, authority was granted to hold Institute meetings under the auspices of the Industrial Power Committee, with the co-operation of the Cleveland and Pittsburgh sections, in Cleveland, O., on March 18 and 19, and in Pittsburgh, Pa., on April 15 and 16.

Harry P. Gibbs was appointed local honorary secretary for India for the term of two years; Gano Dunn was re-appointed as the Institute's representative upon the Board of Trustees of the United Engineering Society; and Ralph D. Mershon was confirmed as a member of the Edison Medal Committee.

The organization of a student branch at the Virginia Polytechnic Institute, where S. R. Pritchard is professor, was authorized.

Annual Meeting of Western Society of Engineers.

The forty-fifth annual meeting and dinner of the Western Society of Engineers was held on the evening of January 13 at the Auditorium Hotel, Chicago. Nearly 400 members and guests, among them the most prominent engineers in Chicago and vicinity, sat down to an excellent dinner enlivened by music, fake telegrams and witticisms by the toastmaster, Douglas Malloch.

In the formal part of the program, Secretary J. H. Warder presented an abstract of his annual report, reviewing the principal activities of the Society during the past year; a total membership of 1,189 was reported.

E. H. Lee, outgoing president of the Society, made his retiring address. He referred to some of the things accomplished by his administration, credit for effecting which was largely due to exceptionally active work by the other officers and by the committees. One thing achieved was the increase in good fellowship through social meetings, smokers, etc. He touched on the engineering achievements of 1914, particularly the completion of the Panama Canal. One feature of the year was the hue and cry about alleged railroad mismanagement and inefficiency. On the contrary, anyone acquainted with the general management of railroads knows that on the whole it is far more efficient than that of nearly all governmental activities and even of most business concerns. In closing, he dwelt on the importance of railroad prosperity and showed how it influences the general welfare of the country.

Mr. Lee then turned over the administration to the newly elected officers, as follows: President, William B. Jackson; first vice-president, Ernest McCullough; second vice-president, Charles B. Burdick; third vice-president, P. B. Woodworth; treasurer, C. R. Dart; trustee (for three years), O. P. Chamberlain.

President Jackson's inaugural address on assuming office emphasized the importance of engineering societies to the engineering profession, whose improved standing is due in no small degree to the activities of these societies. We must look to them for inspiration and for continually broadening the field of engineering endeavor. The basic principles underlying engineering, such as honesty, economy, efficiency, fairness, charity, are essential not only for pure engineering work, but also for an increasing range of occupations. We need only visualize what could be accomplished by a wider application of engineering principles to see the importance of broadening the field of the engineer's activities.

The opinion is generally expressed that engineers have not been given the recognition that is due them in public and private affairs of magnitude. Mr. Jackson contended that this is not true; on the contrary, engineers have received the recognition they deserved and, if this recognition has not amounted to much, it was because they have not taken sufficiently active interest in general affairs. They have usually been too narrow, believing that engineering knowledge is applicable only to physical structures. They must realize the wider utility of engineering principles and methods. Therefore he urged the Society during the present year to limit as far as possible the presentation of papers and discussions dealing with the mathematics and dry facts of engineering and to devote as much attention as possible to its broader applications.

R. A. White made an address on the status of the Philippine Islands, which he visited last summer. Although he considered it as contrary to the best traditions of our government to hold the islands against their will, he had found so many evidences of the beneficent effects of American occupation, that he would be reluctant to see the islands turned over now to reactionary and revolutionary native interests before they were ready for self-government. Dr. White felt that this would require renewed American intervention or, this being declined, would open the way for seizure by some foreign power at the first opportunity.

Harry A. Wheeler, formerly president of the Chicago Association of Commerce, addressed the Society on business tendencies. He first lauded engineering training and contrasted it with the distorted or narrowing training required for journalism, medicine and law. His appreciation of engineering training was shown by his selection of it for his son, who in all probability will never be an engineer, but a banker. He believed that engineering is becoming more and more administrative. A marked tendency of the times is toward commission regulation of various classes of business. This has already been effected as regards common carriers and many other utilities. Since commission regulation of business is inevitable, business interests must co-operate freely with the regulatory commissions. Mr. Wheeler said the railroads showed poor judgment by failing to co-operate with the Interstate Commerce Commission when that body was created in 1883; the hostility shown railroad corporations was largely due to this. He said he heartily believes in regulation, but not in strangulation. The latter can be avoided by business interests meeting the commissions half way.

He cited the case of the recently created Federal Reserve Board; while the act establishing it was pending before Congress, bankers in general opposed it and particularly the provision for an advisory board composed of trained bankers. Since the organization of the Reserve Board and the Advisory Board, practically all bankers have seen the value of the expert advise contributed by the Advisory Board in the harmonious and effective working out of the law. Similar action is desirable with reference to the Federal Trade Commission. If this advisory and co-operative work cannot be put on a legal basis, it should be done voluntarily. Mr. Wheeler urged engineers to take an active part in this co-operation with commissions. In the past many commissions have shown a tendency to assume that they represented the interests of the general public only, forgetting that business men, railroads, utilities, and all the other interests regulated deserve equal representation as part of the body politic as a whole.

Harry Olson, chief justice of the Municipal Court of Chicago, made the concluding address. He explained the work and jurisdiction of this court, which probably transacts more business annually than any other court in the world. Judge Olson pointed out how efforts at improvement of court procedure are generally opposed by the legal fraternity. He called attention to the need for selecting judges of the highest type and freeing them from all obligations except to secure justice. Referring to the value of scientific investigations of youthful and confirmed criminals by the most skilled psychologists, alienists and criminologists, he predicted a complete change in criminal law so as to deal scientifically with the many defectives and degenerates criminally inclined.

On January 14 the Western Society of Engineers devoted the day to an inspection tour of some half dozen important industrial and engineering undertakings in and near Chicago. About 500 members and guests made the trip, for which a special train was provided. The party had luncheon as guests of Sears, Roebuck & Company.

The festivities connected with the annual meeting were brought to a close by a smoker on the evening of January 14 in the Society's rooms. At this Dr. George P. Wheeler gave an illustrated lecture on the San Diego and San Francisco expositions being held this year. Countless beautifully colored lantern slides were shown, also several motion pictures of the Grand Canyon of the Colorado and of Yellowstone National Park. The Armour Glee and Mandolin Clubs provided music.

Physical Light.

At the meeting of the Chicago Section, Illuminating Engineering Society, to be held on the evening of January 29, Clayton H. Sharp, of New York City, will deliver an address entitled "Knowns and Unknowns of Physical Light."

TWO-PHASE AND THREE-PHASE LAP WINDINGS IN UNEQUAL GROUPS.

By E. M. Tingley.

The following method of grouping lap windings in unequal groups per phase per pole, for induction motors and alternating-current generators, and similar apparatus, has the advantage of largely increasing the number of combinations, of slots, poles and phases that may be used, over those obtainable with equal groups per phase per pole. While it may not be new, it is not generally known or used. The form in which it is herewith presented may be new. Several designing engineers have used such windings in special cases, but apparently without investigating all the possible combinations.

The continuous or two-circuit retrogressive and progressive windings, in which the number of slots is one more or less than a multiple of the number of pairs of poles, are now seldom used, either as closed or continuous windings, or as open windings, for the stators of induction motors or alternating-current generators. Such windings were used a few years ago in rotating-armature generators, and they are now used frequently in wound induction-motor rotors, partly on account of the wave form of end connectors, and also for obtaining desired ratios between stator and rotor slots. To obtain balanced or symmetrical phases as regards current and voltage, the number of coils per phase must be equal. Possibly such windings have not been used more frequently because it has been thought that the required number of slots for a particular case would answer only for that case, and also because acceptable combinations of slots and poles are very limited in number. With such windings in open connection it is immaterial whether the end connections are of the wave or the lap form. In general the form of end connections that give the best mechanical construction should be used. We will here assume that the number of coils is equal to the number of slots.

The point to be made, however, is that these unequally grouped windings will give an electrical performance similar to the equally grouped windings almost universally used.

Now there are also a large number of other similar combinations, of slots, poles and phases, having an unequal number of slots per phase per pole, or a fractional number of slots per phase per pole, as have the two-circuit windings, that will give symmetrical or balanced lap windings in the open-circuit connection, but which may not be conveniently two-circuit connected with the wave form end connectors, but which will require the lap form of end connectors.

The method of analysis for obtaining these group combinations for three phases and for two phases is as follows.

A little study with a simple circular diagram of poles and slots will show that three equally spaced slots will give three balanced phases, as regards voltage, with any number of pairs of poles not a multiple of three. The same is also true of any number of equally spaced slots which is a multiple of three.

Therefore, any multiple of three slots will give three balanced phases with any number of pairs of poles not a multiple of three.

The minimum number of slots for three phases with any other number of poles is determined from the factors of that number of poles. Six poles may be considered as 3 two-pole machines in one, and as 3 slots is the minimum number for two poles, then 9 slots or any multiple of 9 slots will give balanced phases with six poles. Thirty poles is the same as 3 ten-pole machines in one, and therefore any multiple of 9 slots will give three balanced phases with 30 poles.

In the same way it will be found that any multiple of 4 slots will give two balanced phases with any odd number of pairs of poles.

The number of slots for the even numbers of pairs of poles is determined from the factors of the number of poles.

For example, 12 poles may be considered as two six-pole machines in one, and as 4 slots is the minimum number for six poles, any multiple of 8 slots will give two balanced phases with 12 poles.

Some of the above combinations will of course give a whole number of slots per phase per pole, or equally grouped windings.

For quick inspection of all the possible combinations of slots and poles the following tables for three phases and for two phases have been prepared. They may be readily written out on the typewriter and blue-printed. Such tables may be extended indefinitely as regards slots or poles.

Table No. I gives the minimum number of slots for three and for two phases for any number of poles up to 140.

Table No. II shows all the possible three-phase balanced windings up to 48 poles and 150 slots. The character under the number of poles indicates the type of winding for the number of slots opposite.

Table No. III gives the same data for balanced two-phase windings up to 48 poles and 204 slots.

TABLE I.—BALANCED LAP WINDINGS IN EQUAL AND UNEQUAL GROUPS.

Any number of slots which is a multiple of the number opposite the number of poles will give balanced windings.

Poles.	Three-phase.	Two-phase.
2	3	4
4	3	8
6	9	4
8	3	16
10	3	4
12	9	8
14	3	4
16	3	32
18	27	4
20	3	8
22	3	4
24	9	16
26	3	4
28	3	8
30	9	4
32	3	64
34	3	4
36	27	8
38	3	4
40	3	16
42	9	4
44	3	8
46	3	4
48	9	32
50	3	4
52	3	8
54	81	4
56	3	16
58	3	4
60	9	8
62	3	4
64	3	128
66	9	4
68	3	8
70	3	4
72	27	16
74	3	4
76	3	8
78	9	4
80	3	32
82	3	4
84	9	8
86	3	4
88	3	16
90	27	4
92	3	8
94	3	4
96	9	64
98	3	4
100	3	8
102	9	4
104	3	16
106	3	4
108	81	8
110	3	4
112	3	32
114	9	4
116	3	8
118	3	4
120	9	16
122	3	4
124	3	8
126	27	4
128	3	256
130	3	4
132	9	8
134	3	4
136	3	16
138	9	4
140	3	8

In all these windings the phases have, in a given case, equal numbers of coils.

Where the number of coils per phase per pole is not equal, the average position of the coils compensates for this inequality and balances the phases electrically.

Of course there is a practical lower limit to the number of slots per pole that may be used, say one slot per phase per pole. The larger the number of slots the more uniform will be the armature reaction at the different poles, though in generators built with a small number of slots per phase per pole nonuniform armature reaction has not been apparent.

From the three-phase table for 4 to 48 poles, inclusive, and from 3 slots per pole up to 150 slots, the number of unequally grouped windings is about

TABLE II.—THREE-PHASE LAP WINDINGS IN EQUAL AND UNEQUAL GROUPS.

Slots	Poles 2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48
3	=	0	.	0	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.
6	=	*	.	*	0	.	0	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.
9	=	0	*	0	0	*	*	0	.	0	*	*	*	*	0	*	*	.	*	*	*	*	*	.
: 12	=	=	.	*	*	.	*	*	.	*	0	.	0	*	*	*	*	.	*	*	.	*	*	.
15	=	0	.	0	*	.	0	0	.	*	*	.	*	0	.	0	*	.	*	*	.	*	*	.
18	=	*	=	*	*	*	*	*	.	*	*	*	*	*	*	*	0	.	0	*	*	*	*	.
21	=	0	.	0	0	.	*	*	.	0	0	.	*	*	.	*	*	.	*	0	.	0	*	.
: 24	=	=	.	=	0	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	0	.
27	=	0	*	0	*	0	*	*	.	*	*	.	0	0	*	*	*	.	*	*	.	*	*	.
30	=	*	.	*	=	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.
33	=	0	.	0	*	.	*	0	.	*	*	.	*	*	0	0	*	.	*	*	.	*	*	.
: 36	=	=	=	*	0	=	0	*	.	*	*	.	*	*	*	*	*	.	*	*	.	*	*	.
39	=	0	.	0	0	.	*	0	.	0	*	.	*	*	.	*	*	.	0	0	.	*	*	.
42	=	*	.	*	*	.	=	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.
45	=	0	*	0	*	*	*	*	.	0	*	*	*	*	.	*	*	.	*	*	*	0	0	.
: 48	=	=	.	=	*	.	0	=	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.
51	=	0	.	0	0	.	*	*	.	0	*	.	0	*	.	*	*	.	*	*	.	*	*	.
54	=	*	=	*	0	*	*	*	=	0	*	*	*	*	*	*	*	*	*	*	*	*	*	.
57	=	0	.	0	*	.	0	0	.	*	*	.	*	0	.	*	*	.	*	*	.	*	*	.
: 60	=	=	.	*	=	.	*	*	=	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.
63	=	0	*	0	*	*	*	0	.	*	*	*	*	*	0	*	*	.	*	*	.	*	*	.
66	=	*	.	*	0	.	*	*	.	=	*	.	0	*	.	*	*	.	*	*	.	*	*	.
69	=	0	.	0	0	.	0	*	.	0	*	.	*	0	.	*	0	.	*	*	.	*	*	.
: 72	=	=	=	=	*	=	*	*	.	*	0	=	*	*	.	*	*	.	*	*	.	*	*	.
75	=	0	.	0	*	.	*	*	.	*	*	.	*	*	.	*	*	.	0	*	.	*	*	.
78	=	*	.	*	*	.	0	*	.	*	0	=	*	*	.	*	*	.	*	*	.	*	*	.
81	=	0	*	0	0	*	0	*	0	*	*	*	*	*	0	*	*	.	*	0	*	*	*	.
: 84	=	=	.	*	0	.	=	*	.	*	*	.	=	*	.	*	0	.	*	*	.	*	*	.
87	=	0	.	0	*	.	*	0	.	*	0	.	*	*	.	*	*	.	*	*	.	0	*	.
90	=	*	=	*	=	*	0	*	.	*	*	.	0	*	=	*	*	.	*	*	.	*	*	.
93	=	0	.	0	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	0	.
: 96	=	=	.	=	0	.	*	=	.	*	*	.	*	*	=	*	*	.	0	*	.	*	*	.
99	=	0	*	0	0	*	0	*	.	0	*	*	*	0	*	*	*	.	*	0	*	*	*	.
102	=	*	.	*	*	.	*	*	.	*	*	.	*	*	=	*	*	.	*	*	.	*	*	.
105	=	0	.	0	*	.	*	0	.	*	*	.	0	*	.	*	*	.	*	*	.	*	*	.
: 108	=	=	=	*	*	=	*	*	=	*	*	*	*	*	=	*	*	.	*	*	.	*	*	.
111	=	0	.	0	0	.	0	0	.	0	0	.	*	0	.	0	*	.	*	*	.	0	*	.
114	=	*	.	*	0	.	*	*	.	*	*	.	*	*	.	*	*	.	=	*	.	*	0	.
117	=	0	*	0	*	*	*	*	.	*	*	*	*	*	*	*	*	.	*	*	*	*	*	.
: 120	=	=	.	=	=	.	0	*	.	=	0	.	*	*	.	*	0	.	=	*	.	*	*	.
123	=	0	.	0	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.
126	=	*	=	*	0	*	=	*	.	*	*	*	*	*	.	*	*	.	*	=	*	*	*	.
129	=	0	.	0	0	.	0	0	.	0	*	.	0	*	.	0	*	.	*	*	.	*	*	.
: 132	=	=	.	*	*	.	0	*	.	=	*	.	*	*	.	*	*	.	0	*	.	=	*	.
135	=	0	*	0	*	.	0	*	.	*	*	.	*	*	0	*	*	.	*	*	.	*	*	.
138	=	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	=	.
141	=	0	.	0	0	.	0	*	.	0	*	.	0	*	.	*	*	.	*	0	.	*	*	.
: 144	=	=	=	=	0	=	=	.	*	0	=	0	*	*	.	*	*	.	*	*	.	*	*	=
147	=	0	.	0	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.
150	=	*	.	*	=	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.	*	*	.

: Slots for two phases also.
= Equal group windings.
* Unequal group windings.
0 Two-circuit, unequal group windings.

TABLE III.—TWO-PHASE LAP WINDINGS IN EQUAL AND UNEQUAL GROUPS.

Slots	Poles 2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48
4	=	.	0	.	0	.	*	.	*	*	.	*	*	.	*	.	*	.	*	.	*	*	*	.
8	=	=	0	.	*	*	0	.	0	*	.	*	*	.	*	.	*	.	*	.	*	*	*	.
: 12	=	.	=	.	*	.	*	.	*	.	0	.	0	*	.	*	*	.	*	.	*	*	*	.
16	=	=	0	=	0	*	*	.	*	*	*	.	*	*	0	.	0	.	*	.	*	*	*	.
20	=	.	0	.	=	.	0	.	*	*	.	*	*	.	*	.	*	.	0	.	0	*	*	.
: 24	=	=	=	.	0	=	*	.	*	*	.	*	*	.	*	.	*	.	*	.	*	*	0	.
28	=	.	0	.	*	.	=	.	0	*	.	*	*	.	*	.	*	.	*	.	*	*	*	.
32	=	=	0	=	*	*	*	=	*	0	*	*	*	.	*	.	*	.	*	.	*	*	*	.
: 36	=	.	=	.	0	.	0	.	=	.	*	.	*	.	*	.	*	.	*	.	*	*	*	.
: 40	=	=	0	.	=	*	*	.	*	=	*	.	0	*	.	*	*	.	*	.	*	*	*	.
44	=	.	0	.	0	.	*	.	0	.	=	.	*	.	0	.	*	.	*	.	*	*	*	.
: 48	=	=	=	=	*	=	0	.	*	=	*	.	*	*	.	*	*	.	*	.	*	*	*	.
52	=	.	0	.	*	.	*	.	*	*	.	=	*	.	*	.	0	.	*	.	*	*	*	.
56	=	=	0	.	0	=	*	.	*	0	.	*	=	*	*	.	*	.	0	.	*	*	*	.
: 60	=	.	=	.	=	.	*	.	*	*	.	*	*	=	=	.	*	.	*	.	*	*	*	.
64	=	=	0	=	0	*	0	=	0	*	.	*	0	*	*	=	*	.	*	.	0	*	*	.
68	=	.	0	.	*	.	*	.	*	*	.	*	*	.	*	.	=	.	*	.	*	*	0	.
: 72	=	=	=	.	*	=	*	.	=	*	.	*	*	.	*	.	*	=	*	.	*	*	*	.
76	=	.	0	.	0	.	0	.	*	0	.	*	0	.	0	.	*	.	=	.	*	*	*	.
80	=	=	0	=	=	*	*	.	0	=	*	*	*	.	*	.	*	.	*	=	*	*	*	.
: 84	=	.	=	.	0	.	=	.	*	*	.	*	*	.	*	.	0	.	*	.	=	*	*	.
88	=	=	0	.	*	*	*	.	*	=	*	*	*	.	*	.	*	.	*	.	*	=	*	.
92	=	.	0	.	*	.	0	.	*	*	.	*	0	.	*	.	*	.	*	.	*	*	=	.
: 96	=	=	=	=	0	=	*	=	*	*	=	*	*	.	*	.	*	.	0	.	*	*	*	=
100	=	.	0	.	=	*	*	.	0	*	0	*	*	.	*	.	*	.	*	.	*	*	*	.
104	=	=	0	.	0	*	0	.	*	*	.	=	*	.	0	.	*	.	*	.	0	*	*	.
: 108	=	.	=	.	*	*	*	=	*	*	.	*	*	.	*	.	*	.	*	.	*	*	*	.
112	=	=	0	=	*	*	=	*	*	*	.	*	=	*	*	.	*	.	*	.	*	*	*	.
116	=	.	0	.	0	.	*	.	0	*	.	*	0	.	*	.	*	.	*	.	*	*	0	.
: 120	=	=	=	.	=	=	0	.	*	=	0	.	*	=	*	.	0	.	*	.	*	*	*	.
124	=	.	0	.	0	*	*	.	*	*	.	*	*	.	*	.	*	.	*	.	*	*	*	.
128	=	=	0	=	*	*	*	=	*	*	*	*	*	.	*	=	*	.	*	.	*	*	*	.
: 132	=	.	=	.	*	.	0	*	=	*	.	=	*	.	*	.	*	.	0	.	*	*	*	.
136	=	=	0	.	0	*	*	.	0	*	.	*	*	.	0	.	=	.	*	.	*	*	*	.
140	=	.	0	.	=	.	*	.	*	*	.	*	*	.	*	.	*	.	*	.	*	*	*	.
: 144	=	=	=	=	0	=	*	.	=	0	=	0	*	*	.	*	*	=	*	.	*	*	*	.
148	=	.	0	.	*	.	0	.	*	*	.	*	*	.	*	.	*	.	*	.	0	*	*	.
152	=	=	0	.	*	*	*	.	0	*	.	*	*	.	*	.	0	.	=	.	*	*	*	.
: 156	=	.	=	.	0	.	*	.	*	=	.	*	=	.	*	.	*	.	*	.	*	*	*	.
160	=	=	0	=	=	*	0	=	=	*	.	*	*	.	*	.	*	.	*	=	*	*	0	.
164	=	.	0	.	0	.	*	.	*	0	.	*	*	.	0	.	*	.	*	.	*	*	0	.
: 168	=	=	=	.	*	=	=	.	*	*	.	*	0	=	*	.	*	.	*	.	*	=	*	.
172	=	.	0	.	*	.	*	.	0	*	.	*	*	.	*	.	*	.	0	.	*	*	*	.
176	=	=	0	=	0	*	0	.	*	=	*	*	*	.	*	.	*	.	*	.	*	=	*	.
: 180	=	.	=	.	=	.	*	.	=	*	.	*	*	.	=	.	*	.	*	.	*	*	*	.
184	=	=	0	.	0	*	*	.	*	*	.	*	*	.	*	.	*	.	*	.	*	*	=	.
188	=	.	0	.	*	.	0	.	0	*	.	*	*	.	*	.	0	.	*	.	0	*	*	.
: 192	=	=	=	=	*	=	*	.	*	*	=	*	*	=	*	=	*	.	*	.	*	*	*	=
196	=	.	0	.	0	.	=	.	*	*	.	*	0	.	0	.	*	.	*	.	*	*	*	.
200	=	=	0	.	=	*	*	.	*	=	*	*	*	.	*	.	*	.	*	.	*	*	*	.
: 204	=	.	=	.	0	.	0	.	*	.	*	.	*	.	*	.	=	.	*	.	*	*	*	.

: Slots for three phases also.
= Equal group windings.
* Unequal group windings.
0 Two-circuit, unequal group windings.

six times the number of equally grouped windings, which will be of considerable advantage to the designer. The different number of poles that may be wound with a given number of slots by using the unequal and the equal groupings is considerably increased over the different numbers of poles that may be wound with equal groupings only. With 4 poles, for each possible winding in equal groups, there are 3 windings in unequal groups. With 8 poles there are 7 unequal group windings for each equal group winding, and with 10 poles the number of unequal group windings is 9 times the number of equal group windings, etc.

With 108 slots balanced three-phase windings may be made for any number of poles met with in ordinary practice, besides a number of two-phase windings. This is of great practical value in induction motor designing as standard or existing punchings may be used for special motors. In two and three-speed induction motors, using one, two or three primary windings, it will greatly facilitate the design by allowing a greater choice in the number of slots that may be used.

A 14-pole, three-phase, 126-slot, squirrel-cage induction motor may be carrying a certain load which will permit a desirable increase or decrease in speed. Usually this would require a new motor, but Table II shows that, as far as the stator slots are concerned, stator windings for 8, 10, 12, or 16 poles could be applied. Possibly simply re-connecting the old stator winding for 12 or 16 poles would be practicable.

A desirable generator winding often requires a few more or less conductors than may be obtained in equal groups per phase per pole, and a small increase or decrease in the number of slots would permit the use of the winding. If in designing a 20-pole, 120-slot, three-phase generator, it may be found that a winding having two conductors per slot is very desirable, but this would give about 10 per cent too few or too many conductors; the larger number of conductors may be employed by using fractional-pitch coils and 120 slots, but there may be no way of increasing the smaller number of conductors except by making a very undesirable winding. However, by using unequal groups of coils the number of slots may be increased or decreased to any extent in steps of three, and the number of conductors thereby properly adjusted.

Any of these three-phase windings may be connected in star or delta. They may also be connected in multiple circuits where the series of coils permit.

With lap windings the number of

TABLE IV.—SAMPLE "LEAST-COMMON-MULTIPLE DIAGRAM" FOR DETERMINING NUMBER OF COILS IN EACH PHASE GROUP.

For such diagrams use section paper.
Three-phase; 20 poles; 144 slots; 60 phase groups.
Least common multiple for 144 slots and 60 phase groups is 720.
Slot interval, 5 spaces. Phase groups, 12 spaces. Pole groups, 36 spaces.

Poles	Phase A.	Phase B.	Phase C.
1	0 . . . . 0 . . . . 0 .	. . . 0 . . . . 0 . . .	. 0 . . . 0 0
2	. . . 0 . . . . 0 . . .	. . 0 . . . . 0	0 . . . 0 . . . . 0 .
3	. . 0 . . . . 0	. 0 . . . . 0 0	. . . 0 . . . . 0 . .
4	. 0 . . . . 0 0	. . . . 0 . . . . 0 . .	. . 0 . . . . 0 . . .
5	0 . . . . 0 . . . . 0 .	. . . 0 . . . . 0 . . .	. 0 . . . . 0 . . . .
6	0 . . . . 0 . . . . 0 .	. . . 0 . . . . 0 . . .	. 0 . . . 0 0
7	. . . 0 . . . . 0 . . .	. . 0 . . . . 0	0 . . . 0 . . . . 0 .
8	. . 0 . . . . 0	. 0 . . . . 0 0	. . . 0 . . . . 0 . .
9	. 0 . . . . 0 0	. . . . 0 . . . . 0 . .	. . 0 . . . . 0 . . .
10	0 . . . . 0 . . . . 0 .	. . . 0 . . . . 0 . . .	. 0 . . . . 0 . . . .
11	0 . . . . 0 . . . . 0 .	. . . 0 . . . . 0 . . .	. 0 . . . 0 0
12	. . . 0 . . . . 0 . . .	. . 0 . . . . 0	0 . . . 0 . . . . 0 .
13	. . 0 . . . . 0	. 0 . . . . 0 0	. . . 0 . . . . 0 . .
14	. 0 . . . . 0 0	. . . . 0 . . . . 0 . .	. . 0 . . . . 0 . . .
15	0 . . . . 0 . . . . 0 .	. . . 0 . . . . 0 . . .	. 0 . . . . 0 . . . .
16	0 . . . . 0 . . . . 0 .	. . . 0 . . . . 0 . . .	. 0 . . . 0 0
17	. . . 0 . . . . 0 . . .	. . 0 . . . . 0	0 . . . 0 . . . . 0 .
18	. . 0 . . . . 0	. 0 . . . . 0 0	. . . 0 . . . . 0 . .
19	. 0 . . . . 0 0	. . . . 0 . . . . 0 . .	. . 0 . . . . 0 . . .
20	0 . . . . 0 . . . . 0 .	. . . 0 . . . . 0 . . .	. . 0 . . . . 0 . . .

Number of coils in each phase group.

| | | |

PROMOTING SERVICE.

By John G. Montgomery.

The train dispatchers of electric railways are usually recruited from the steam railroads, and the result is that a majority of the train dispatchers employed by electric railways are ignorant of the fundamentals of electricity as it enters into their work.

Co-operation between the train department and the operating or power department is necessary if the railway is to be operated with efficiency and dispatch.

The train dispatcher is perhaps familiar only with such phrases as "horsepower" and what constitutes a "machine" or generator, but the chances are that he is uninstructed about the distribution, and the amount of power delivered to the cars or train units, and also the capacity of the generators which furnish the energy necessary to propel the cars.

Realizing that any information in regards to the method of distribution of the power on the line would be appreciated by the train and power departments of electric railways I have prepared a graphic chart, illustrating what may be termed the "straight-line" char-

Fig. 1.

acteristic of current distribution between two sources of power operating in parallel, from a simple case of applied mechanics as illustrated in the figure, and explained in the following text.

When the wires are continuous from terminal to terminal and the power stations connected in parallel with one another between trolley and rail, such a problem as that assumed above would involve the determination of what portion of the current of the car was supplied from each of the power stations.

In the Fig. 1 A is a car at distances B and C from power stations No. 1 and No. 2. If the car is drawing a current I_a it may be assumed that its current demand on power station No. 1 is,

$$I_1 = CI_a/(B+C)$$

Then the current taken from power house No. 2 is

$$I_2 = BI_a/(B+C)$$

With this understanding a problem in feeder-current distribution, for any system similar to the above, is not difficult to solve.

In plotting the graphic chart, Fig. 2, the portion of the current of the car supplied from each of the two power stations was determined by the above methods and the resulting data were plotted as illustrated.

In referring to Fig. 2 the uninstructed should understand that a direct-current generator is always rated in kilowatts; this means that a generator which has a rating of 300 kilowatts (300,000 watts) at 600 volts, will take care of a current demand of 500 amperes at full load. However, the full-load rating should not be considered as the maximum rating, for manufacturers guarantee 50 to 100 per cent overload, for short intervals of time; this means that a generator having a rating of 500 amperes at full load will take care of current demands of 500 to 1,000 amperes for a given interval of time; this interval of time is usually sufficient to take care of the starting-current demands of the cars, which is from 1.5 to 2 times as great as the normal current required by the cars operating at full speed.

It is important to remember that each generator is protected from excessive loads by a device known to electrical men as a circuit breaker, which opens

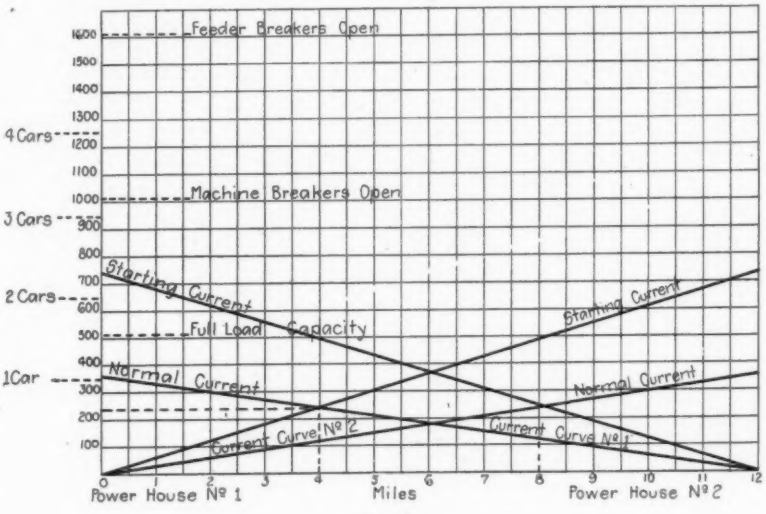


Fig. 2.

the circuit automatically, when the current demand exceeds a predetermined amount, usually at 100 per cent overload.

Whenever the number of cars to be operated causes a demand for an extra generator, the generators are protected by what is known as a feeder circuit-breaker, which opens at about 200 per cent overload.

I have noted on the chart the points of feeder and circuit-breaker interruptions, so in referring to the current demands of any car or train units the question whether the station should operate one or two generators can be determined at once.

Louisville Electrical Clearing House Reviews Year.

A record of accomplishments was read at the first annual meeting of the Louisville Electrical Clearing House held several days ago and at which all the officers of the organization were re-elected. Much has been accomplished during the year the organization has been in effective existence, the first thing done being adoption of the loop system of wiring in place of the knob and tube system which hitherto had been permissible. The regulation extended beyond the city into all parts of Jefferson county and at the meeting question was amended to extend wherever the lines of the Louisville Gas & Electric Company run, these lines having since the method was approved crossed the county boundaries. Promulgation of the new city regulation as to all-metal construction inside the fire district and in tenements and factories outside, and as to metal mouldings everywhere after July 1, is also to be attributed in an important measure to the approval of the Clearing House.

The special address at the meeting was delivered by Robert Montgomery, manager of the commercial department of the Louisville Gas and Electric Company, and dealt with the concentric system of wiring, Mr Montgomery treating the subject from the angle of the central station and speaking in its approval. He asked that the contractors at least wait until the system had been passed upon before they made up their minds as to its practicability.

C. C. Childers, of the electrical contracting firm of Childers & Waters, was re-elected president of the organization; F. G. Burdorf, Burdorf-Brecher Company, vice-president; C. H. Brown, Paradis Electrical Company, secretary, and Joseph Hofgesang, sergeant-at-arms. E. C. Knoop, of the Kentucky Actuarial Bureau, in the headquarters of which the Clearing House holds its sessions, formerly was secretary but goes to Milwaukee about the last of this month to be associated with the Wisconsin Bureau for an indefinite time. The organization has a membership of between 35 and 40.

Suggestion Advanced for a National Electrical Week.

Acting upon a suggestion advanced by the Society for Electrical Development, representatives of leading electrical manufacturers, central stations, jobbers, contractors, dealers and trade journals, at a special meeting held Friday, January 8, in the Society's office, voted in favor of planning a great national electric week to be held in the United States and Canada some time next fall.

It was decided to recommend to the Board of Directors of the Society to make this a big sales and educational week, during which time all affiliated interests would co-operate with national manufacturers, civic bodies, etc., to boost for the better lighting of streets, stores, factories, schools and homes, and it will be the aim of the movement to promote the sale of electrical appliances, motors, in fact everything electrical and to aid the development of the electrical industry by conducting house wiring campaigns in every city.

Mr. Wakeman acted as chairman of the meeting and as discussion took place as to the practicability and desirability of the Society promoting an Electric Carnival Week.

It was the consensus of opinion of those present that such a week would be of tremendous value to everyone engaged in the electrical industry, as it would call the attention of the public in the most forcible manner possible to the many uses of electricity, would stimulate the men in the industry itself and impart a boom to general business throughout the entire country. It was decided to recommend to the Board of Directors at its next meeting that the Society promote a national electrical carnival week, the choice of the committee being the week beginning October 18.

Among the suggestions made in connection with this proposition were the co-operation of the Jovian Order and other electrical societies and associations; the co-operation of national advertisers in using their space in the magazines to arouse the interest of the public, and in getting all their customers to make special window displays during that week; securing the co-operation of mayors, boards of trade and other civic bodies; having "white way" lighting and other attractions that week to bring people into the cities; electrical contractors to encourage all merchants to fix up their windows for that week; central stations to offer prizes for best lighted stores, best display of electrical merchandise, best display of other merchandise, also to carry on a liberal advertising campaign in their local newspapers prior to and during electrical week, securing the co-operation and support of the other local electrical interests in this; parades to be held of electric vehicles and wherever possible, floats, etc. The Society is to prepare special posters for billboard and other use, to be sold at cost for advertising the Carnival prior to and during the week itself, to prepare special literature for distribution by central stations, supply dealers, contractors and others, to arrange for lectures, special meetings of electrical societies, stories in trade papers, popular magazines, etc.

If the Board accepts this suggestion a special committee will be appointed to take charge of this work under the direction of the general manager of the Society, sub-committees and the Society's local committees all over the United States and Canada taking charge of the details.

Other publicity plans were discussed and the meeting adjourned after the chairman had expressed on behalf of the Society the appreciation of the attendance and co-operation of those present. In doing so Mr. Wakeman emphasized the fact that the members of the Society are the Society; that the staff is engaged to carry out the wishes of the Society and that active co-operation among the members themselves is not only important but essential to the successful carrying out of the work for which the Society was organized.

The staff of the Society for Electrical Development held its regular monthly meeting at the offices of the Society at 10 a. m. the same day, at which the managers of the various sections reported the activities of the past month. The object of these meetings is to keep all the members of the staff posted upon everything being done by the Society, and to afford opportunities for suggestions for further activities.

George B. Muldaur, in reporting upon the work of Section I, called attention to the fact that every city of 100,000 population or over has been visited by representatives of the Society during the past four months.

Since the last meeting H. C. Spaulding has resigned and has been succeeded by H. W. Alexander, who now has charge of the editorial and advertising departments. The Society has also engaged Miss Grace T. Hadley, who entered upon her duties January 1. She will have charge of the publicity work of the Society dealing with household electrical devices, particularly with the work intended to appeal to the women users.

Peoria Electric Club.

The Peoria Electric Club has elected the following officers: president, Tom Eadsley; vice-president, T. D. Buckwell; secretary, R. V. Stureman. The bylaws have been changed and now the Club meets on the first and third Saturdays of each month at 12:30 p. m. at the Jefferson Hotel.

The meetings have been well attended and a Committee on Membership has been appointed to increase the membership. The Entertainment Committee, of which E. H. Joseph is chairman, has taken hold of the work and is providing interesting meetings. Some special speaker will be on the program for each meeting.

The Engineering Foundation.

The Engineering Foundation, inaugurated by the United Engineering Society, is the name given to a fund to be "devoted to the advancement of the engineering arts and sciences in all their branches, to the greatest good of the engineering profession and to the benefit of mankind."

The administration of this fund will be entrusted to the Engineering Foundation Board, elected by the trustees of the United Engineering Society and composed of 11 members, nine from the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, and the American Institute of Electrical Engineers, and two chosen at large.

The initial gift for The Engineering Foundation is from a noted engineer whose name will be announced at the inauguration ceremonies, Wednesday, January 27, 1915, at 8:30 p. m. in the auditorium of The Engineering Societies Building, 29 West Thirty-ninth Street, New York City.

The speakers at this inauguration meeting will be: Gano Dunn, president of the United Engineering Society and past-president of the American Institute of Electrical Engineers; Henry S. Pritchett, president of the Foundation for the Advancement of Teaching; Robert W. Hunt, past-president of the American Institute of Mining Engineers; Alexander C. Humphreys, past-president of the American Society of Mechanical Engineers.

Ladies will be cordially welcomed.

Illuminating Engineering Society.

At a meeting of the Council of the Illuminating Engineering Society, held January 14, 1915, in New York City, M. Luckiesh, chairman of the Committee on School Lighting, submitted the manuscript of a paper entitled "Safeguarding the Eyesight of Children"; this paper, with 18 slides, is to be used for a lecture on school lighting for presentation at meetings of school authorities throughout the country. Copies of the lecture will be made available.

The proposal to create a class of members to be known as fellows was received and after considerable discussion was laid on the table.

The following committee appointments were confirmed:

Committee for Remodeling the Lighting of the General Offices: H. E. Ives, chairman; Clarence L. Law and Thomas W. Scofield. Advisory members: L. B. Marks and George W. Cassidy.

Committee on Factory Lighting: C. E. Clewell, chairman; W. A. D. Evans, T. J. Litle, Jr., R. E. Simpson, and G. H. Stickney.

Committee on Constitutional Revision: W. D. Weaver, chairman; Louis Bell, L. B. Marks, Preston S. Millar, and C. H. Sharp.

Committee on Popular Lectures: C. F Scott.

Insulation Resistance of Solids.

The volume resistivity of a large number of solid dielectrics has been determined by H. L. Curtis, of the Bureau of Standards, as given in the following table:

Material	Resistivity in ohm—centimeters
Special Paraffin	over 5000×10^{15}
Ceresin	over 5000×10^{15}
Fused Quartz	over 5000×10^{15}
Hard Rubber	1000×10^{15}
Clear Mica	200×10^{15}
*Sulphur	100×10^{15}
*Amberite	50×10^{15}
*Rosin	50×10^{15}
*Mica (India ruby slightly stained)	50×10^{15}
G. E. No. 55 R.	40×10^{15}
Hallowax No. 5055 B.	20×10^{15}
Mica (Brown African clear)	20×10^{15}
Bakelite L558	20×10^{15}
*Electrose No. 8	20×10^{15}
*Parowax (paraffin)	10×10^{15}
Glyptol	10×10^{15}
*Shellac	10×10^{15}
Kavalier Glass	8×10^{15}
*Insulate No. 2	8×10^{15}
*Sealing Wax	8×10^{15}
*Yellow Electrose	5×10^{15}
*Duranoid	3×10^{15}
*Murdock No. 100	3×10^{15}
*Yellow Beeswax	2×10^{15}
Khotinsky Cement	2×10^{15}
*G. E. No. 40	1×10^{15}
*G. E. No. 55A	1×10^{15}
Moulded Mica	300×10^{12}
Unglazed Porcelain	300×10^{12}
Redmonite (157.4)	200×10^{12}
Black Electrose	100×10^{12}
Tetrachlornaphthalene	50×10^{12}
Mica (India ruby stained)	50×10^{12}
German Glass	50×10^{12}
Paraffined Mahogany	40×10^{12}
Stabalite	30×10^{12}
Plate Glass	20×10^{12}
Hallowax No. 1001	20×10^{12}
Dielectrite	5×10^{12}
Bakelite No. 5199 RGRB	5×10^{12}
Bakelite No. 150	4×10^{12}
Gummon	3×10^{12}
Tegit	2×10^{12}
Opal glass	1×10^{12}
Paraffined Poplar	500×10^{9}
Bakelite No. G5200 RGR	400×10^{9}
Paraffined Maple	300×10^{9}
Bakelite No. 1	200×10^{9}
Bakelite No. 190	100×10^{9}
Italian Marble	100×10^{9}
Bakelite Micarta	50×10^{9}
Bakelite No. G 5074	40×10^{9}
Black Condensite	40×10^{9}
Yellow Condensite	40×10^{9}
Vulcabeston	20×10^{9}
White Celluloid	20×10^{9}
Hard fiber	20×10^{9}
Black Galaith	20×10^{9}
Lavite	20×10^{9}
White Galaith	10×10^{9}
Hemit	10×10^{9}
Red Fiber	5×10^{9}
Marble, Pink Tennessee	5×10^{9}
Marble, Blue Vermont	1×10^{9}
Ivory	200×10^{6}
Slate	100×10^{6}
Bakelite No. 140	20×10^{6}

*Apparent resistivity taken after the voltage had been applied for 15 minutes.

The electric vehicle is especially suited to the delivery of food products. Meat, butter, fish, etc., should never be permitted to lie in a gasoline car.

LETTER TO THE EDITOR.

"Kelvin" for the Unit of Electric Energy.

To the Editor:

With increasing ramifications and extensive development of the use of electricity, it is of very great importance that the terms and designations in the electrical industry be simplified and minimized in order that confusion and misunderstanding may be averted.

Electricity as it is sold and applied is, from an economic viewpoint, dependent upon two factors: (1) The full load or maximum demand. (2) The extent or hours of use of the demand.

The demand is the power applied in doing work, and the electrical unit for measuring it is the kilowatt. It is described as follows:

"Electric power, which is the rate at which energy is being transformed in a circuit, is expressed by the product of the instantaneous values of electromotive force and current in the circuit. The practical unit is the kilowatt, which is 1,000 times greater than the watt, i. e., the amount of power when the instantaneous values of the electromotive force and the current are respectively one volt and one ampere."

The amount of energy expended in doing work is the product of the average energy applied and the duration of time during which said energy is applied. The common electrical term therefor is the kilowatt-hour.

It may be found convenient in the sale of electric power to charge on the basis of the kilowatt demand alone, the energy in kilowatt-hours consumed alone, or, as customary, by a combination of the two preceding methods.

In view of the several conditions that are ordinarily encountered in practice, among which are the need of comparisons, the non-technical men who through the nature of their business happen to deal with matters electrical, and the personal element and inevitable carelessness, insurance against some of the possible difficulties is essential.

Therefore, the terms kilowatt and kilowatt-hour, while directly related, carry a different significance, as already indicated and *the oversight or unintentional dropping of the suffix "hour" from kilowatt may create a serious and possibly costly misunderstanding.*

For the best interest of the electrical business it seems evident that an appropriate substitute for the term kilowatt-hour is highly desirable, and it is fitting that the unit of quantity of energy be designated as "kelvin" in distinction of the memorable work of Lord Kelvin. This thought had its inception at the last International Electrical Congress, and was at that time recommended for adoption, and not unlike the appeal for the substitution of the term myriawatt for boiler horsepower (although of a somewhat different application) should receive the endorsement and support of the entire electrical industry.

W. B. WALLIS.

Pittsburgh, Pa., January 19, 1915.

Chicago Vehicle Meeting.

At the meeting of the Chicago Section of the Electric Vehicle Association, held on Tuesday, January 19, a paper was read by George A. Arnold, of the Lincoln Electric Company, entitled "Charging Apparatus for Private Garages." This paper first considered the importance of proper charging for a vehicle battery and its effect upon the battery life. Automatic charging apparatus is generally desired. The factors which must be considered in automatic equipment were then taken up and the disadvantages of the mercury-arc rectifier stated. The requirements of an ideal automatic apparatus were then set forth and a description given of the Lincoln charging outfit which was said to more nearly meet these requirements than any other method. A description of this outfit will be found in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, December 5, 1914. Mr. Arnold then gave a comparison of figures for the cost of operation.

The discussion consisted mainly in questions put to Mr. Arnold regarding the details of the apparatus.

Mr. Chalfonte was then called upon to give his impressions of the New York Automobile Show, from which he had just returned. He stated that there was a better buying sentiment exhibited at the show than is customary, in spite of the fact that business conditions in the East are in general worse than in the West and Middle West. Automobile dealers in the East look for better business in 1915 than in 1914. The co-operative electric garage which has been planned in New York City is to open in February.

In addition to the regular meeting of the Section on Tuesday, January 26, it is probable that other luncheon meetings will be held during the week on account of the Chicago Automobile Show which will then be in progress.

Pittsburgh Electrical Association Elects Officers.

At the first monthly meeting of the new year, in the Seventh Avenue Hotel, Tuesday evening, January 5, the Pittsburgh Electrical Association, of Pittsburgh, Pa., elected officers for the entire year as follows: President, J. W. Smythe; first vice-president, E. P. Lockhart; second vice-president, J. H. Neal; secretary, George Barris; treasurer, O. J. Goettmann. Trustees, A. J. Pierce and L. J. Kiefer.

New Electrical and Mechanical Appliances

Low-Cost Battery-Lamp Outfit.

An extremely simple and exceptionally low-cost electric-lamp attachment for use on dry cells is illustrated herewith. It consists of a sheet-metal band that is clamped around the body of the cell and carries a combined reflector and socket screw shell. An upstanding wire handle is soldered to the band, to which is also secured a spring contact that can be made to bear against the carbon terminal or positive binding-post of the cell to act as a switch. The lamp is screwed into the socket shell and its center or end contact engages the zinc casing of the cell through a hole that can be easily punctured through the cardboard outer casing or carton. Any kind of dry cell of the standard No. 6 size can be used. The outfit is sold to dealers at 35 cents, without battery, and is to retail at 75 cents, including battery. The complete lantern is handy, safe and, according to the makers, cheaper to use than any oil or acetylene lamp. It is manufactured by the Bass-Moody Company, Peoria, Ill., and bears the trade name "Stepp-O-Lite."

Battery Lamp.

Motor-Driven Mine Pumps.

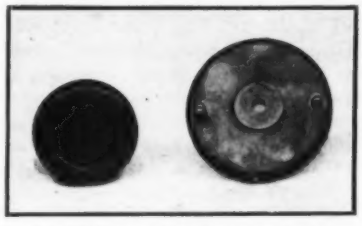
The illustration herewith shows a group of motor-driven pumps developed specially for sump and gathering service in coal mines. These pumps have brass-lined water cylinders, tobin bronze piston rods, and bronze valve seats, stems, springs, stuffing-box caps and glands, and bronze adjustable cross-head shoes, so that they are thoroughly protected against corrosive action of mine water.

The motors are direct-current Westinghouse Electric machines. They are mounted on top of the pump, where they are kept out of the water and are supplied with impregnated windings, which afford protection from dampness. A special feature is the use of automatic control by which the pump can be started and stopped from any convenient point.

The unit formed by motor and pump is very compact and is readily mounted on a truck so that it can be easily transported from place to place.

Electric Mine Pumps Ready for Shipment.

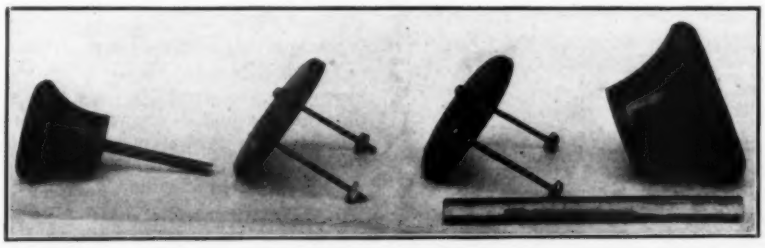
The group shown is a lot ready for shipment one week after receipt of order. The maker is the Weinman Pump Manufacturing Company, Columbus, O.



Handwheel and Dial for Rheostat.

Handwheels for Field Rheostats.

A new type of inexpensive handwheel and dial for field rheostats of the rear-of-board type has been placed on the market by the Ward Leonard Electric Company, Bronxville, N. Y. These handwheels are made in two sizes, of which the smaller size is intended for the six-inch Ward Leonard enameled rheostat, and the larger size for the similar 8, 12 and 15-inch-diameter rheostats. These handwheels and dials are finished in black and make a neat appearance on the front of the switchboard.



Side View of Rheostat Handwheels and Dials.

Inexpensive Excavation by Electric Shovel.

In these days of increasing labor cost and scarcity of capital, every operating company is on the lookout for ways and means by which to effect the most economical and labor-saving operations. The tests made on some excavation work done by the Cleveland Railways Company, Cleveland, O., last summer indicate that this company is reaping the benefit of such economies. In building its Seventy-ninth Street line, the company had to do a considerable amount of excavation for which it employed the electrically driven Thew automatic shovel illustrated on the next page.

This shovel is of the horizontal crowding-motion type and has several other features of interest. It weighs 13 tons, has a dipper with a capacity of five-eighths cubic yard and a clearance height over the house of 12 feet 2 inches. It is mounted on regular car wheels on which it travels on the car tracks and in addition, is equipped with a set of auxiliary traction wheels, 33 inches in diameter, and 15 inches tread, which permits it to run under its own power over the ground, pavement, or wherever it is desired to take it.

The horizontal dipper-crowding motion utilized is said to be particularly adapted to the application of electric drive because of the ease of control and power demands. In excavating material with a shovel, it is necessary first to force the dipper forward into the material, then to hoist it upward through the material. In this case, the first motion is made horizontally, being obtained as follows:

The dipper is suspended by an adjustable arm hinged to a carriage or trolley moving horizontally along a suitable trackway. This enables the shifting of the point of rotation for the dipper, so that the hoisting force is at all times exerted in the most effective manner, while the crowding force is applied horizontally. The combination of the horizontal trackway and the boom channels results in a structure braced and reinforced to withstand the severe strains which the boom is called upon to endure. The trolley motion is controlled by a lever. This lever is further connected to a trip rod which is operated automatically when the trolley reaches the limit of its motion in either direction. The crowding motion enables this type of shovel to be advantageously employed for very shallow excavating operations, such as for track laying.

The entire motive power for traction, hoisting and swinging consists of one 20-horsepower Westinghouse compound-wound 350-volt direct-current motor with a starting and reversing control equipment. The motor operates at approximately constant speed, the various motions being controlled through suitable friction clutches and gears.

Current is usually brought to the shovel through a flexible insulated cable connected to a switch on the truck frame and transmitted through copper rings to brushes suspended from the swinging turntable.

The use of one motor appears to be a particularly desirable feature, for reducing the initial cost, and affording greater flexibility of action in the frequent reversals of the various operating motions; it also means the operation of three levers instead of three separate controllers, and a gain in time over starting and stopping three separate motors. It is distinctly a one-man machine.

The boom is of the jack-knife type with an adjustable section that can easily be lowered, allowing the shovel to pass under the trolley wire, without interfering in any way with the efficiency of its operation. The shovel swings through a complete circle delivering the excavated material at any desired point.

A buffer is furnished which takes up the shock that occurs when the shovel strikes a hard piece of excavation. This allows the shovel to be released and relieves the whole machine from the strain to which it would otherwise be subjected.

The cab is cut away so as to allow plenty of room for passing cars, a feature of particular importance when used on street-railway work.

The illustrations afford an excellent idea of the class of work being done by the Cleveland Railways Company and the manner in which the shovel is operated, while the following data obtained through the courtesy of J. J. Stanley, president, and C. H. Clark, engineer maintenance of way, show the cost of the entire operation.

LOADING.	
Shovel man @ 40c	$ 4.00
Four laborers @ 21c	8.40
Current, oil, repairs, etc	1.50
Loading cost per day	$13.90
HAULING.	
Four men @ 26c	$10.40
Four men @ 19c	7.60
Two men @ 30c	6.00
Hauling cost per day	$24.00
DUMPING.	
1 foreman @ 30c	$ 3.00
6 laborers @ 20c	12.00
Dumping cost per day	$15.00
Cubic yards loaded in 10 hours	540
Cost of loading per cu. yd	2.6c
Cost of hauling per cu. yd	4.4c
Cost of dumping per cu. yd	2.8c
Cost of loading, hauling and dumping	9.8c
Lineal feet excavated on this work	2,700
Number of 10-hour shifts operated	12
Lineal feet excavated per 10-hour shift	225
Cu. yds. loaded per 10-hour shift	450
Average loading cost (450 yds. = $13.90) 3c per yd.	
Average hauling cost (450 yds. = $24.00) 5⅓c per yd.	
Average dumping cost (450 yds. = $15.00) 3⅓c per yd.	
Average loading, hauling and dumping cost 11 5/6c per yd.	
Length of haul	Approximately 6 miles
Average H. P. used in moving shovel	15.0
Maximum H. P. used in moving shovel	20.2
Average H. P. used in operating shovel	11.7
Maximum H. P. used in operating shovel	43.6

Two Views of Thew Electric Shovel Excavating for Cleveland Railways Company.

This shovel is built by the Thew Automatic Shovel Company, Lorain, O., and the electrical equipment by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Fan Campaign of Western Electric Company.

In connection with its 1915 campaign for selling electric fans, the Western Electric Company has issued a folder under the title "Selling Fans," which contains a description of a number of sales helps along this line. The company is furnishing these to electrical contractors, dealers, central stations and others interested in the merchandising of this article.

Among the helps offered are advertising copy and electrotypes for local newspapers, lantern slides for use in local motion-picture theaters, suggestions for window displays, and attractive display cards. The company has also inaugurated a prize contest for the best fan window display which is arranged during the season, using as a basis a background and large wave cut-out furnished by the company and shown in the accompanying illustration of the company's announcement. The fan which is used is supplied by the dealer and the arrangement of the remainder of the display is left to his own judgment and ingenuity. Suggestions are however made as to an appropriate foreground along the line of using real sand to represent a beach, Kewpie dolls, miniature tents, boats, lighthouse, etc. Other suitable objects will occur to the mind of the window dresser.

Here Is Your Opportunity
to win one of these prizes, and, at the same time, obtain the best fan window display outfit ever offered.
It will bring business into your store.
PRIZES
$50.00 First Prize
$25.00 Second Prize
$10.00 Third Prize
$5.00 Fourth Prize
$5.00 Fifth Prize
$5.00 Sixth Prize
Window Display Outfit W-43
WE furnish the background and the large wave cut-out, shown above. The fan is to be taken from your own stock. With this material you construct your window display. Many beautiful and attractive effects may be obtained; sand may be used on the window floor to continue the beach; kewpie dolls, miniature tents, boats, flags, etc., may be used to advantage. Colored lights can be used so as to give good results for a night display.
A miniature boardwalk equipped with small electric lights for a night display would attract attention. These are only suggestions. You are to use your own ingenuity and originality in fixing up the display.
The Following Rules Will Govern the Contest:
The contest will be conducted by the Western Electric News. Photographs should be mailed to Contest Editor—Western Electric News, 463 West Street, New York City. The committee of award will consist of a representative of the
Electrical World Electrical Review Electrical Record
National Electrical Contractor Society for Electrical Development
Order Your Background and Wave Cut-Out Today.
Check Number 43 on the Enclosed Card and Mail Today.

Western Electric Company's Fan-Window-Display Prize Contest.

There are six prizes offered for the best arrangement of window, ranging from $50.00 down to $5.00. It is stipulated that the foreground of the window must be dressed by a member of the competing firm or one of his employees; that it must contain as its basis a fan display; that the display must remain in the show window not less than one week; and that a photograph of the window must be sent to the Western Electric Company by September 1, 1915. A committee to decide upon the award of the prizes will be made up of one representative each of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, the *Electrical World*, the *National Electrical Contractor*, the *Electrical Record* and the Society for Electrical Development.

Illuminated Electric Clock as Part of Lamp Exhibit.

One of the interesting features of the exhibit made by the General Electric Company at the recent New York Electrical Show was a large electric clock brilliantly illuminated by means of Edison Mazda lamps. This clock, a view of which is shown in the accompanying illustration, has been shipped to San Francisco and is being installed as part of the exhibit of the Edison Lamp Works of General Electric Company at the Panama-Pacific International Exposition.

The clock is nine feet high and its dial is 30 inches in diameter. Tubular lamps form the ends of the hands; current is supplied to them through brushes and collector rings attached to the movement. The hour numerals are enameled in black on the ends of 25-watt, round-bulb, frosted lamps. Minute marks are made by short red tubular lamps. The pendulum stem contains 18 ten-watt frosted sign lamps and in place of the pendulum weight there is a 400-watt frosted lamp. Mazda tungsten lamps are used throughout.

In its operation the clock is a secondary timepiece controlled by minute impulses from an 80-beat, self-winding electric master clock. Both the exhibit clock and the less spectacular master clock were manufactured by the Betts & Betts Corporation, 256 West Fifty-fifth Street, New York City.

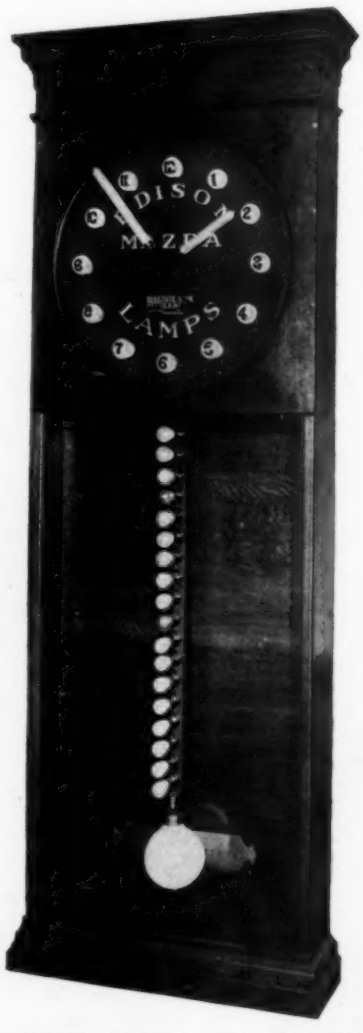
Panama Canal Steamship Lines.

Fourteen regular lines now use the Panama canal.

Modern Battery-Charging Methods for Electric Starting and Lighting Equipments for Gasoline Automobiles.

One of the most interesting developments in the electrical field has been that of the lighting and starting systems now practically standard for all American gasoline motor cars.

Among the difficult problems to solve was how to control the battery-charging current so that the battery was always kept in perfect condition and fully charged and never subjected to conditions which would damage it or exhaust it.



Electrically Operated and Illuminated Clock.

Slipping clutches, solenoids pulling against springs and dashpots, hot wires with changing resistance, and many other cumbersome and unreliable methods of control were extensively used and exhibited at so recent a time as that of the automobile shows in January, 1914.

But at the recent New York Automo-

bile Show practically all of these methods of control for the battery current had been replaced by the method in which there is a small rapidly vibrating contact whose vibratory motion is automatically controlled by the battery current itself, and which in turn automatically controls the battery-charging current.

This sounds rather paradoxical, yet this is a fair description of the method of control which has replaced the slipping clutches, hot wires, solenoids, dashpots, etc.

In view of this state of affairs special importance attaches to a patent (No. 1,122,774) with 24 claims issued December 29, 1914, to H. Ward Leonard, of New York City, which seems to broadly cover this method of controlling the battery-charging current, now so universally used. A group of four patents covering important features of modern gas-electric vehicles was also issued to H. Ward Leonard in December, 1914, based upon applications filed in the Patent Office by him more than eleven years ago.

Electrically Driven Vacuum Sheet-Cleaner for Cylinder Presses.

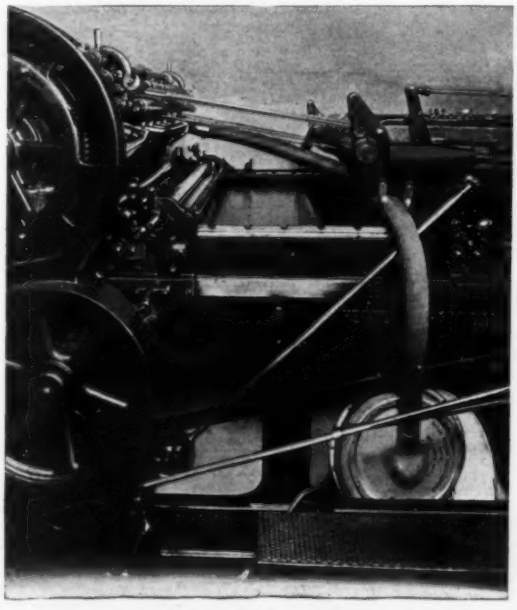
The illustrations herewith are of a vacuum cleaning outfit for use on any cylinder printing, lithograph or offset press. The outfit consists of a series of vacuum cleaning nozzles that are connected to a series of manifolds graduated in size to insure uniform velocity of suction at all points. A hose is attached to these manifolds which runs out and down alongside the press to a motor-driven suction fan that can be installed either under the press or to one side.

The series of nozzles extends the full length of the cylinders and the nozzles are placed in such a position and at such an angle that, as the paper runs on the press, the air suction plays continually on the surface and edges, and removes all the loose dirt and foreign matter. On second revolution of the press all the dirt left from the under side of the sheet is collected before it has a chance to reach the forms, and in this way the forms are kept perfectly clean, insuring clean inking rolls and clean ink in the reservoirs.

Motor-Driven Cleaner Outfit.

The outfit is very light and durable. The nozzles are made of aluminum, faced with brass. The manifold section and fan are also of aluminum, while the blower is of cast iron. The hose running from the blower to the manifold section is a combination of rubber, fabric, and wire. The motor used with the blower is a one-horsepower, direct-current, high-speed, 110 or 220-volt machine manufactured by the Robbins & Myers Company, Springfield, O.

This outfit is known as the "Doyle Vacuum Sheet-Cleaner," manufactured by Britton & Doyle, Cleveland, O.



Vacuum Sheet Cleaner Applied to Press.

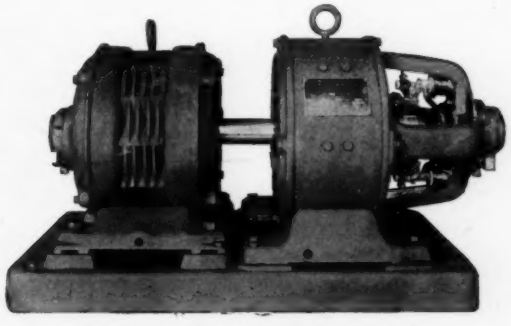
Motor-Generator Sets for Moving-Picture Machines.

Alternating current is very unsatisfactory for operating the arc of the moving-picture machine. The alternating-current arc is unsteady, tends to travel around the edge of the carbons, is hard to focus, and tends to go out. The direct-current arc, on the other hand, is steady, easy to focus because the light comes mainly from a spot on the positive carbon, and gives about twice as much illumination as the alternating-current arc does for the same amount of current.

Since current as received from the central generating station is usually alternating, some means must be provided by motion-picture theaters to transform it into direct current. For this purpose the motor-generator set has proved itself thoroughly satisfactory and has been purchased in greatly increased numbers during the past year. The motor-generator set consists simply of an alternating-current motor receiving power from the lines and driving a generator which supplies direct current of the proper voltage for the arc.

The Westinghouse Electric motor-generator set is especially designed for motion-picture service. The generator has a high overload capacity and is compound wound so that it gives and delivers a potential of 75 volts at all loads, instead of allowing the voltage to drop as the load is increased, as is usual with shunt generators. These characteristics are of value because they enable the set to operate two moving-picture machines at once (one projecting and the other "warming up") without interfering with the picture being shown or altering the speed of the machine, if motor driven.

Seventy-five volts was selected as standard because the arc requires about 50 volts, and experience shows that the most stable arc is obtained when about 25 volts is absorbed in ballast resistance. This motor-generator set requires practically no attention and has no costly parts that require frequent renewal. Its attendance and maintenance cost is practically negligible.



Motor-Generator for Motion-Picture Use.

Latest Approved Fittings

CONDUIT BOXES.—Appleton Electric Company, 212 North Jefferson Street, Chicago, Ill.

For use with rigid conduit.

Pressed, steel, sherardized or enameled catalog Nos. 3-C, 3-O, 4-CLD, 4-O, 4-OD, 4-SN, 4-SND, 4-SSL, 5-C.

"No-Thread," pressed steel, types J and K.

Wattmeter connection boxes, catalog Nos. 2600 to 2622 inclusive, 2625 to 2627 inclusive, 2630 to 2635 inclusive, 2640 to 2645 inclusive.

For use with flexible tubing.

Pressed steel, sherardized or enameled, catalog Nos. 506-L, 507-L, 508-L, 514-L, 515-L.

Also above types with steel or porcelain covers or with porcelain bushings.

Approved December 17, 1914.

CONDUIT BOXES.—National Metal Molding Company, Fulton Building, Pittsburgh, Pa.

"National" sherardized pressed-steel boxes.

Extension rings, catalog Nos. 2604-05, 2616-17, 2692, 2704-05, 2716-17, 2792.

Also above types with flanged plates, catalog Nos. 2648-50 inclusive, for use in concrete construction.

Approved December 7, 1914.

CONDUIT OUTLET BUSHINGS AND COUPLINGS.—Appleton Electric Company, 212 North Jefferson Street, Chicago, Ill.

Weatherproof service entrance fittings having threaded hubs for attachment to rigid conduit. Catalog Nos. 2376 to 2387 inclusive.

Outlet bushings for rigid conduit, made of sherardized malleable iron. Catalog Nos. 8029 to 8042 inclusive.

Approved December 17, 1914.

CONDUIT OUTLET PLATES.—National Metal Molding Company, Fulton Building, Pittsburgh, Pa.

"National" sherardized steel outlet plates. Catalog Nos. 2648-50 inclusive.

Approved December 7, 1914.

CURRENT TAPS.—Harvey Hubbell, Incorporated, Bridgeport, Conn.

"Hubbell" current taps, 600 watts, 250 volts.

Multiple type, catalog Nos. 5327, 5331, 5687, 5783, 5881, 5955, 5987, 5979.

Approved December 10, 1914.

HANGERS, LAMP AND FIXTURE.—Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Weatherproof suspension fitting, catalog Nos. 6028-C, 6031, 6031-M, 6049, 6049-M, 6050-M.

Standard for use with lamp clusters and reflector sockets on low-potential circuits.

Approved November 27, 1914.

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

RECEPTACLES, Standard. — The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins." Keyless, porcelain shell. Conduit box, catalog Nos. 4075, 4076.

Approved December 10, 1914.

RECEPTACLES, Standard.—H. T. Paiste Company, Thirty-second and Arch Streets, Philadelphia, Pa.

"Paiste," cleat rosette receptacles for link fuses, 3 amperes, 125 volts. Brass shell.

Key, catalog Nos. 5591, 5810, 34193-94, 50730.

Keyless, catalog Nos. 5595, 5814, 9436, 34197, 50733.

Pull, catalog Nos. 5615, 5818.

Porcelain shell.

Keyless, catalog Nos. 9434, 38136, 38395.

Also above with shadeholders attached.

Standard for use only in large mills.

Approved December 15, 1914.

RHEOSTATS.—S. J. Stewart, 312 Corondelet Street, New Orleans, La.

7.5 horsepower or less, 250 volts.

These starters, for alternating-current motors, consist of wire-wound resistance coils inclosed in a case. A three-pole, double-throw knife switch with an extra set of contact clips on one side and extensions for inclosed fuses at the other, is mounted on a slate base. Springs are provided to prevent switch being left in running position.

Approved December 14, 1914.

SIGNAL APPLIANCES. — Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Factory signal horns. Type G, rating 6-110 volts, direct and alternating current.

Approved December 1, 1914.

SIGNAL APPLIANCES.—Edwards & Company, 140th and Exterior Streets. New York, N. Y.

"Recti" weatherproof bells for alarm and signaling systems. Type 100-U for battery circuits and for other circuits of voltages not over 250 volts.

Approved November 13, 1914.

SIGNAL APPLIANCES. — General Fire Extinguisher Company, Providence, R. I.

"GFE" bell, weatherproof type, for alarm and signaling systems.

Approved November 13, 1914.

SIGNAL APPLIANCES. — Spies Electric Works, 562 West Van Buren Street, Chicago, Ill.

"Selco" weatherproof bell, for battery circuits of alarm and signaling systems.

Approved November 13, 1914.

SOCKETS, Standard.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"C-H," 660 watts, 250 volts.

Brass shell.

Push-button, catalog No. 7504.

Keyless, catalog Nos. 7515, 7505.

Porcelain shell.

Push-button, catalog No. 7405.

Approved December 10, 1914.

SOCKETS, Standard.—Pass & Seymour, Incorporated, Solvay, N. Y.

"P. & S." brass-shell sockets.

Key, catalog Nos. 414, 818, 822, 61457, 61577, 100412, 100414, 100415, 100421, 100423, 100425.

Keyless, catalog Nos. 475, 100415, 100417, 100422, 100424, 100426.

Pull, catalog No. 476.

Also above types with shadeholders attached, with composition or insulated metal key, with or without extension keys and pull sockets with extension chain guide or insulating link in chain.

Approved December 10, 1914.

SWITCHES, Combination. Cutout. —D. & W. Fuse Company, Providence, R. I.

"D. & W." service entrance switches. Cast-iron boxes containing two or three-pole porcelain or slate cutout bases for National Electrical Code standard cartridge inclosed fuses. Covers of boxes fitted with an interior insulated attachment connected with an outside handle by which fuses may be engaged and withdrawn or replaced as cover is opened or closed.

"Waterproof" style 31-60, 61-100 and 101-200 amperes, 250 volts, catalog Nos. 1900 to 1902 inclusive and 1905 to 1907 inclusive.

Motor-starting switch, 30 amperes, 250 volts, alternating current, catalog No. 2501. A special three-pole knife switch on a porcelain base with clips for cartridge inclosed fuses which, when switch is in starting position, are short-circuited. The device is mounted in a cast-iron cabinet with an external handle whereby the switch is operated.

Approved December 10, 1914.

SWITCHES, Surface Snap, Supports for.—The D. & S. Manufacturing Company, 221 Michigan Street, Toledo, O.

"D. & S." base plate.

This device is a pressed-steel base for use on lath and plaster walls and ceilings in mounting surface snap switches.

Approved November 24, 1914.

Current Electrical News

ATLANTIC STATES.

AUBURN, ME.—Mayor Fowler wishes the city to install a municipal lighting plant, utilizing a vacant school building for a station and generate by steam, or else erect a station on Taylor Brook on the Nezinscot River and generate by water power. It is estimated that about $50,000 would equip the school building with a steam plant. The city now pays about $250 per month for electricity bought for water pumping, and about $10,000 a year for street and public buildings lighting. W.

BANGOR, ME.—The city electrician has asked the council to buy a steam turbogenerator of 750-kilowatt capacity, to supplement present electrical equipment, at an estimated cost of $15,000. W.

FRANKLIN, N. H.—Citizens of this city are interested in the extension of the Concord Electric Railway from Penacook to Boscawen Plaine, and thence to Franklin. The people of the town through which the road would penetrate are working to secure the building of the road. W.

NORTH ADAMS, MASS.—This city is to make extensive improvements in its public lighting. As rates for electricity under a new contract just made with the North Adams Gas Company the city will pay $78 per year for 310-watt arc lamps and $18 per year for 50-watt incandescents. The prices heretofore paid for such lamps were $80 and $25, respectively.

SALEM, MASS.—The Naumkeag Mills has entered a contract with the Salem Electric Lighting Company to furnish power for 1,600 motor drives for the Naumkeag plant, which is to be entirely motor driven. This will necessitate the building of an addition to the electric lighting plant, which is to be rushed so as to be completed as soon as the new mills of the Naumkeag plant are finished.

SOUTH HADLEY FALLS, MASS.—At a special town meeting January 5 the town voted to raise $40,000 to purchase the local lighting plant from the Amherst Power Company.

BATH, N. Y.—The plan which is being laid out by Charles Larrows for the location of lamps for lighting the village streets, calls for 200 lamps, where about 80 are now employed. The new lighting plant will be ready for work by May 1.

PHILADELPHIA, PA.—W. E. S. Dyer, engineer and architect, has been retained by the Philadelphia Dye Works to prepare plans for a power plant equipment to include engines, generators, motors, with foundations, and also a stack.

GREEN SPRINGS, FLA.—S. I. Talmadge and C. O. Lohmeier have a franchise to erect a light and power plant.

NORTH CENTRAL STATES.

CANTON, O.—The plan for a municipal lighting plant at Canton, O., has been disposed of, for a time, at least, by action taken last week by the city council in tabling the request of petitioners for an election on the matter. The action was taken on the report of the lighting committee of the council, which pointed out that the city cannot afford additional bond issues at this time.

FINDLAY, O.—The Modern Light and Power Company, incorporated here with a capital stock of $10,000, proposes to establish an electric power plant. R. C. Bishop and others are interested. L.

FINDLAY, O.—The Electric Construction and Motor Company has increased its capital stock from $15,000 to $30,000, and will secure funds to enable it to extend its plant and facilities. L.

HAMILTON, O.—The West Side Commercial Association is having an estimate made of the cost of installing ornamental cluster lights on the west side of the city. Superintendent O'Toole, of the city light plant, will present a survey, and the organization expects to have the lights installed, to be paid for on a co-operative basis. L.

LISBON, O.—The Lisbon Electric Light Company is planning to expend $15,000 for improving plant. Address manager.

NORWOOD, O.—The Norwood lighting plant is to be changed from direct to alternating current in the process of making the improvements provided for by a bond issue of $105,000 voted in November, and a large amount of work for electricians will result, on account of the corresponding change in equipment, industrial and domestic, which will be necessary. About 3,000 consumers are affected. L.

SHELBY, O.—The town has sold electric light, bridge and sewer bonds to the amount of $50,000, and part of the proceeds will be used in the construction of a municipal electric plant. The mayor is supervising plans. L.

SPRINGFIELD, O.—Property-owners are preparing to install cluster electric lamps in front of their places of business in the central district, as soon as wiring can be arranged for and a uniform type of cluster and standard settled upon.

SULLIVAN, ILL.—Voters at a special election held here voted in favor of the issuance of $18,000 bonds for improvements at the municipal electric light plant.

CADILLAC, MICH.—The business men plan to install a boulevard lighting system. Address E. J. Hayns.

COLLINS, IOWA.—The Maxwell Electric Light & Power Company has applied for a franchise to the city council, to supply electricity for lamps and motors for the town.

KALONA, IOWA.—A company is being organized with a capital of $10,000 to establish electric lighting. Address S. G. Bell.

SCHLESWIG, IOWA.—The sum of $16,000 is to be expended for a municipal lighting plant. Address city clerk.

ALTMONT, MO.—Penn Love, of Gallatin, has petitioned for franchise to install an electric light plant.

PLEASANT HILL, MO.—Ways and means are being considered by the council to install electric lights. Address village clerk.

FRANKFORT, KANS.—Steps are being taken to organize a company to supply current for light and power, and to operate an ice plant. The present purpose is to get current from the Marshall County Power and Light Company, connecting with its lines at Blue Rapids. M.

GARNETT, KANS.—After a delay of one year, the city of Garnett has acquired a municipal lighting system. Under a decision given by District Judge Smart, the city will pay $12,960.87 as the purchase price of the light plant heretofore owned by J. Q. McAfee. The city voted bonds of $15,000 for the purchase or construction of a lighting plant in the winter of 1913-14, but no agreement could be reached as to the value of the McAfee plant until decided by the court. M.

SOUTH CENTRAL STATES.

NASHVILLE, TENN.—The Cumberland Mountain Mineral Company, a $100,000 corporation authorized to build electric plants and to develop mines, has been granted a charter. The principal offices are at Cumberland Gap and the incorporators are Victor Bentner, Henry P. Spilker, J. D. Temlin, G. W. Montgomery and Frank Montgomery.

FORT SMITH, ARK.—Because of the increased demand for service the merchants of Fort Smith who are interested in the plan to establish a co-operative electric plant, have decided to increase the capital stock from $10,000 to $50,000.

GORDON, ARK.—Engineer Albert C. Moore, Bartlett Building, Joplin, Mo., is preparing plans for electric light plant, waterworks and sewer system. Estimated cost, $102,000. Address R. S. Stevens, mayor.

PRAIRIE VIEW, TEX.—An appropriation of $200,000 is asked for the Prairie View Normal School. The new improvements include a steam and electrical plant, $30,000; laundry building, $20,000, and water mains for fire protection, $12,600. Address secretary of Board.

WESTERN STATES.

FAIRVIEW, MONT.—The city council has been petitioned for an electric light and power franchise by C. W. Jenison, who contemplates constructing a power plant in or near this city. The franchise asked for is for a period of 30 years. O.

PLENTYWOOD, MONT.—Prominent men of the city, according to a recent report, will form a company and take over the holdings of the Plentywood Electric Light & Water Company, and will rehabilitate and extend same into the outlying districts. According to the initial announcement funds have been pledged and work will be inaugurated in the spring. O.

KAMIAH, IDAHO.—The Rawson-Works Lumber Company, here, contemplates installing an electric lighting plant in this city, the power to be furnished from its planing mill plant about one mile north of town. The company now lights its mill and yards with a small plant located at the mill. O.

PHOENIX, ARIZ.—Plans have been prepared by the city electrician for the extension of the ornamental lighting system on Central Avenue north and south to the city limits.

VALDEZ, A. T.—Hunt, Mirk & Company have closed a contract with the Granite Gold Mining Company of this place for its entire power plant equipment and transmission lines.

COUPEVILLE, WASH.—A company, which has for its purpose the construction of an electric light and power plant in or near this city, has recently been formed. Prominent men of this locality, including merchants of this city and farmers in this district, are identified with the movement. It is reported that money to finance the proposition has been raised, a site has been selected and that active construction will be started eary in the spring. According to preliminary estimates the plant and equipment will cost approximatey $30,000. For further information address Coupeville Bank. O.

SEATTLE, WASH.—The city council has directed the mayor and comptroller through the legal department to make immediate application to the government for power permits on the Sauk and Suiatle Rivers in the Washington and Snoqualmie national forests, having in mind the possible development of a municipal power site in the two watersheds.

SEATTLE, WASH.—The public utilities committee of the city council has by unanimous vote recommended the light extension bill for passage over the mayor's veto. The bill proposed to appropriate $10,000 to extend the municipal light and power system to Tukwila, Foster and contiguous territory.

SALEM, ORE.—It is reported that this city is contemplating entering the light and water field by constructing and operating a municipal light and water plant. Mayor White and several members of the city council have gone on record as favoring the proposition. From figures obtained by Mayor White the lighting plant alone could be erected and made ready for operation for between $200,000 and $250,000. The matter will come before the council for definite settlement in the immediate future. O.

SILVERTON, ORE.—The Portland Railway Light & Power Company of Portland, through the Salem division, is negotiating with the local city council relative to the installation of a more adequate lighting system in this town. The Portland corporation has signified its intentions of starting the work as soon as the council orders. The installation will cost complete about $5,000. O.

AUBURN, CAL.—A new power line is to be built shortly by the Tell Electric Company from this city to serve the Shirland Tract and Long Valley.

AUBURN, CAL.—The Pacific Gas and Electric Company is to resume its construction work in this county this year. Agents are now in the field securing rights of way for the tower line between the No. 4 and No. 5 power houses, work on which was started before the construction work of 1913 was shut down. The tower line is to consist of 80-foot towers built of steel, resting on cement foundations, 16 feet square.

LONG BEACH, CAL.—The Board of Public Works has awarded a contract to the Woodhill-Hulse Electric Company, of Los Angeles, to install an ornamental lighting system on First Street and certain other streets.

PROPOSALS.

SWITCHBOARD.—Sealed proposals, in duplicate, will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until January 26, for supplying one switchboard. Interested firms should call for proposal 741.

ELECTRICAL EQUIPMENT, NAVY DEPARTMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until February 2, for furnishing the folowing electrical equipment: 5,000 searchlight carbons; 100,000 feet double conductor; 36,000 feet telephone cord; 5,500 feet twin conductor wire, as per schedule 7803, and 72,000 feet lamp cord, as per schedule 7800, all for delivery at Navy Yard, Brooklyn, N. Y.; miscellaneous induction motors, as per schedule 7816, for delivery at Navy Yard, Norfolk, Va.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained by writing (mentioning file number) to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or to the nearest of its branches at Boston, New York, Atlanta, Chicago, New Orleans, Seattle and San Francisco.]

NO. 15,164. ELECTRICAL APPLIANCES FOR WIRELESS TELEGRAPHY.—A business man in New Zealand has informed an American consul that he is desirous of getting into communication with manufacturers and exporters of optical goods and electrical appliances for wireless telegraphy. He is particularly anxious to do business with firms on the Pacific Coast.

NO. 15,173. COPPER CABLES, WIRE AND TUBES.—An American consular officer in Europe reports that he is in receipt of a communication from a corporation in his district, which operates five electric power plants throughout the country, requesting that it be put in communication with American manufacturers and dealers in copper cables, copper wire, and drawn copper tubes.

NO. 15,182. ELECTRIC CRANES.—An American consular officer reports that a royal decree has been published authorizing the purchase of four electric cranes for use in the port of Valencia, Spain. Plans and specifications are on file in the office of the Secretaria de la Junta de Obras del Puerto de Valencia, Valencia, and in the office of the Ministerio de Fomento, Secion de Puetos, Madrid. A list of persons who are in a position to represent American firms may be obtained on application to the Bureau of Foreign and Domestic Commerce or its branch offices.

NO. 15,184. ELECTRICAL SUPPLIES.—An electrical engineer of one of the leading cities in South America has requested an American consular officer to secure for him catalogs, etc., for electrical supplies, including wire, cable, conduit, etc. Prices should be f. o. b. New York, or, preferably, c. i. f. destination. Catalogs in Portuguese are preferred.

NO. 15,198. VACUUM CLEANERS.—A business firm in Italy reports to an American consul that it wishes to receive offers, accompanied by catalogs, etc., on movable and stationary vacuum cleaners, with a view to securing the exclusive agency for that country. Reference will be given. Correspondence may be in English.

NO. 15,220. ELECTRIC LIGHTING FIXTURES.—An American consular officer in Canada reports that a firm in his district desires to be put in touch with American manufacturers of electric lighting fixtures, with a view to representing them in that market on a commission basis.

NO. 15,243. ELECTRICAL APPLIANCES.—A firm in South America has informed an American consul that it desires to import electrical appliances in general, telephone and telegraph supplies, rubber goods for automobiles and industrial purposes. Correspondence should be in Spanish.

NO. 15,251. TELEPHONE EQUIPMENT AND SUPPLIES.—An American consul in South America reports the name and address of a firm which is negotiating with the government for the installation of a modern telephone system. It is stated that one member of the firm is an American.

NO. 15,260. HARDWARE, IMPLEMENTS, ELECTRICAL SUPPLIES, ETC.—An American consular officer in Russia reports that a business man in his district desires to secure the names and addresses of firms in the United States manufacturing or dealing in electric lamps, electric mountings (sockets, receptacles, etc.), dynamos, couplings for engines, steam engines, tools of every description, hand and steam pumps, belting, agricultural implements, steel for tools, lanterns, plumbers' supplies, alcohol stoves, aluminum ware, and padlocks. Correspondence may be in Russian, German, or French.

NO. 15,265. STEAM ENGINES, ELECTRIC MACHINERY, ETC.—An American consular officer in the Far East reports that a firm in his district desires catalogs, price lists, and discounts on steam engines and boilers for electric power plants and electric machinery (direct current). Correspondence may be in English.

NO. 15,270. PORCELAIN ELECTRICAL FITTINGS.—An importing company in the United Kingdom advises an American consular officer that it wishes to purchase large quantities of porcelain electrical fittings. It is stated that this firm has formerly transacted extensive business with American exporters and manufacturers.

NO. 15,312. ELECTRICAL SUPPLIES, ETC.—An American consul in Europe has transmitted a detailed report relative possibilities for the sale of American electrical supplies, excavating, hydraulic, and mining materials in his district. A copy of the report may be had on application to the Bureau.

NEW PUBLICATIONS.

LIFE OF CROSSTIES.—The Forest Service, Washington, D. C., has issued Bulletin No. 118 entitled "Prolonging the Life of Crossties," by Howard F. Weiss. This gives the results of experiments which include preservative treatments.

BUREAU OF STANDARDS.—The annual report of the director of the Bureau of Standards, Washington, D. C., has been issued for the year ended June 30, 1914. This report shows electrical testing and researches to be an important feature of the Bureau's work. Questions of life hazard in electrical work and public-utility investigations are among the newer researches undertaken.

FINANCIAL NOTES.

The Associated Gas and Electric Company will hold its annual meeting January 27, in Jersey City.

Bondholders of Western Canada Power Company have approved the modifications in the mortgage by which certain lands are released from under the mortgage and the mortgage closed for the present at $6,000,000 with provision for an ultimate increase to $10,000,000 as net earnings increase. The closing of the mortgage was done at the request of intending purchasers of its bonds. The releasing of the lands will enable the company at some future time to build a second generating station and issue first-mortgage bonds against such construction without reference to the present mortgage.

An issue of $4,000,000 one-year collateral trust five-per-cent notes has been sold by the Pacific Gas & Electric Company, subject to approval by the California Railroad Commission. The proceeds derived from the sale of these notes, it is understood, will be used in financing notes maturing March 25. The amount of the original issue was $7,000,000, and the company anticipated payment on more than $2,000,000 some time ago, in addition to retiring an additional amount from the sale of preferred stock, leaving at present but $4,000,000 of the notes outstanding.

Dividends.

	Term	Rate	Payable
Automatic Elec.	Q	1 %	Feb. 1
Colo. Ry., Pr. & Lt.	Q	1.25%	Feb. 8
Colo. Ry., Pr. & Lt. pf. Series B	Q	1.25%	Feb. 8
Dayton Pr. & Lt. pf.	Q	1.5 %	Jan. 15
Com. Pr., Ry. & Lt. com.	Q	1 %	Feb. 1
Com. Pr., Ry. & Lt. pf.	Q	1.5 %	Feb. 1
East St. L. & Sub. pf.	Q	1.25%	Feb. 1
Edison El. Ill. Bos.	Q	3 %	Feb. 1
Elec. Bond & Share pf.	Q	1.5 %	Feb. 1
Elec. Bond & Share com.	Q	2 %	Jan. 15
Ft. Worth Pr. & Lt. pf.	Q	1.75%	Feb. 1
Jacksonville Trac. pf.	Q	$1.50	Feb. 1
Lowell Elec. Lt.	Q	1 %	Feb. 1
Sierra Pac. Elec. pf.	Q	$1.50	Feb. 1
York Rep. pf. (payable in script)	S-A	2.5 %	Jan. 30

PERSONAL MENTION.

MR. C. F. BENHAM, until recently engaged in electrical engineering in Minneapolis, is now with the Great Western Power Company, San Francisco.

MR. GEORGE C. CONNOR, of the Pettingell-Andrews Company, Boston, Mass., addressed the Electrical Association of Wentworth Institute, Boston, January 8, on the subject of "Electric Lighting."

MR. W. R. HERSTEIN, secretary-treasurer of the Electric Supply Company, Memphis, Tenn., has been selected by the Insurance Exchange of Memphis as its representative on the Board of Electrical Examiners and Supervisors for 1915.

MR. JAMES H. McALLISTER has been appointed acting city electrician of Cambridge, Mass., to fill the vacancy caused by the resignation of Mr. Timothy H. Ahearn. The duties of the office include the supervision of the police and fire signal systems and the street lighting.

MR. ALBERT SCHEIBLE, formerly of the firm of Lotz & Scheible, patent attorneys, has opened a separate office in the Rector Building, Monroe and Clark Streets, Chicago, Ill. Mr. Scheible, who is well known in Chicago electrical circles, will continue to devote himself to the practice of patent law, in which he has specialized for several years.

MR. R. H. COYNE, formerly with the Kellogg Switchboard and Supply Company, Chicago, has assumed the management of the company's western business, with headquarters in San Francisco, succeeding Mr. H. C. Goldrick, who resigned the first of the year to become associated with the Western Electric Company.

MR. JAMES CLARK, JR., head of the electrical company in Louisville, Ky., which bears his name, was one of the speakers at a recent business men's banquet held in Louisville and said that he believed the manufacturers of Louisville had fared better than those in many sections of the country. Ten years, he said, would see Louisville a big manufacturing city.

MR. R. H. MANSFIELD, for many years connected with the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., and engaged in the electrical manufacturing business for the past 25 years, has purchased the business of the R. C. Wells Company, of Fond du Lac, Wis., manufacturers of coils, master vibrators, motors for starters, small generators and other ignition specialties.

DR. F. G. COTTRELL, inventor of the Cottrell process for the electrical precipitation of fumes by high voltage discharges, was tendered a complimentary dinner on January 15, at the Plaza Hotel, New York City, by the American Institute of Mining Engineers, the American Electrochemical Society and the Mining and Metallurgical Society of America in recognition of his contributions to the field of work of these societies.

MR. JOHN NELSON, for 20 years in charge of the electric lighting plant at Houghton, Mich., has resigned. Mr. Nelson started his present work with the Peninsula Light and Power Company and continued it under the Houghton County Electric Light Company when the Stone & Webster management took charge of the plant. Mr. Nelson has accepted a position in charge of the engineering department of the Northern Division of the Standard Oil Company.

MR. ERRETT L. CALLAHAN, for the past six years manager of the new-business department of H. M. Byllesby & Company, Chicago, has resigned that position to become district manager for the Westinghouse Lamp Company at Chicago. Mr. Callahan's work in organizing and directing the new-business staffs and in building up the gas and electric business served by the Byllesby utility properties has been remarkably successful and characterized by many original campaigns and sales features which secured quick results. His activities have extended into every department of the commercial side of central-station practice and have given him a thorough understanding of utility companies' problems. While with the Byllesby company the commercial departments of all its 35 service organizations were under his care. Mr. Callahan, although a young man, has had a long and varied experience in the electrical industry. He is chairman of the Commercial Section of the National Electric Light Association, having been one of the founders of the Section and successively a member of the executive committee, secretary, vice-chairman and chairman. He has contributed much effort toward the success of the section and has been a frequent contributor to convention programs and to the technical press. Mr. Callahan is a member of the Jovian Order, the Chicago Jovian League, The Electric Club of Chicago, associate member of the American Institute of Electrical Engineers, and member of the Oak Park Club and Oak Park Lodge of Elks. He was born at Scio, N. Y., on May 19, 1876, and educated in the Central High School of Cleveland,

E. L. Callahan.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Jan. 18.	Jan. 11.
American Tel. & Tel. (New York)	118¾	118½
Commonwealth Edison (Chicago)	—	136
Edison Electric Illuminating (Boston)	257	250
Electric Storage Battery common (Philadelphia)	48¾	48½
Electric Storage Battery preferred (Philadelphia)	48¾	48½
General Electric (New York)	143	143
Kings County Electric (New York)	120	120
Massachusetts Electric common (Boston)	7½	8
Massachusetts Electric preferred (Boston)	—	—
National Carbon common (Chicago)	124½	119¾
National Carbon preferred (Chicago)	121½	121
New England Telephone (Boston)	135	133
Philadelphia Electric (Philadelphia)	23⅞	23⅞
Postal Telegraph and Cables common (New York)	73	72
Postal Telegraph and Cables preferred (New York)	67	—
Western Union (New York)	60⅞	59⅝
Westinghouse common (New York)	71½	71¾
Westinghouse preferred (New York)	116	117

Hiram College and the Case School of Applied Science, receiving the Bachelor of Science and Electrical Engineer's degrees from the latter. After leaving college Mr. Callahan received a commission in the War Department as electrical expert assigned to work in connection with a proposed submarine cable from Nome to St. Michaels, Alaska. Later he was engaged for two years in the experimental laboratories of the Crehore-Squier Intelligence Transmission Company and with the Postal Telegraph Company in experiments with automatic telegraphy between New York and Chicago. In 1902 he was with Westinghouse, Church, Kerr & Company, assisting in the electrical equipment of industrial plants and preliminary work on the electrification of the Pennsylvania railroad terminals in and near New York. Turning from the construction to the appliance branch of the industry, Mr. Callahan spent four years with the Simplex Electric Heating Company and the Prometheus Electric Company, retiring as manager of the latter to become manager of the heating department of the Chicago district office of the General Electric Company in 1906. Here he originated plans for instructing central-station companies in the pioneer sales work of household electric appliances and quickly acquired a reputation in this particular field, leading to his selection by H. M. Byllesby & Company in 1909 to organize and direct the business-getting department for the properties under its management.

OBITUARY.

MR. HERBERT NICHOLAS FENNER, president of the New England Butt Company, and for many years prominent in business and social circles in Rhode Island, died at his home at Providence on January 5 in his seventy-second year. Mr. Fenner had a wide acquaintance in the electrical field, particularly among the representatives of the wire industry, growing out of his manufacture of wire-covering machinery. One of his well remembered and greatly appreciated customs was to entertain a number of his electrical friends annually at a Providence clambake. Mr. Fenner was born in Providence on March 13, 1843, the son of Nicholas Arnold and Deborah (Brown) Fenner. He married Emma Frances Brayton, daughter of the late Lodowick Brayton, by whom he is survived. One son, Herbert Lodowick Fenner, also survives him. He obtained his early education in Providence, and after a few years experience in business succeeded his father in the New England Butt Company. He served as treasurer of that concern for many years. He was also a director in the Industrial Trust Company and the Joslin Manufacturing Company. Mr. Fenner took a great interest in public affairs, but never held political office. He was prominent in club life, being one of the founders and first treasurer of the Misquamicut Golf Club, of Watch Hill. He was a member of the American Society of Mechanical Engineers, the Agawam Hunt, the Audubon Society of Rhode Island, the Providence Chamber of Commerce, the Hope Club, the Providence Art Club, the Rhode Island Country Club, the Rhode Island Historical Society, the Rhode Island School of Design, the Squantum Association, the Turks Head Club, and a director of the Puritan Life Insurance Company.

DATES AHEAD.

Northern White Cedar Association. Nineteenth annual meeting, Minneapolis, Minn., January 26-27. Secretary, N. E. Boucher, Minneapolis.

Western Association of Electrical Inspectors. Annual meeting, Hotel Radisson, Minneapolis, Minn., January 26-28. Secretary, W. S. Boyd, 175 West Jackson Boulevard, Chicago, Ill.

National Convention of Builders' Exchanges. Columbus, O., January 26-28. Secretary, J. M. Vollmer, Louisville, Ky.

National Independent Telephone Association. Eighteenth annual convention, La Salle Hotel, Chicago, Ill., February 3-5. Secretary, F. B. MacKinnon, Topeka, Kans.

American Institute of Electrical Engineers. Midwinter convention, New York City, February 17-19. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York, N. Y.

"Made in the U. S. A." Industrial Exposition. Grand Central Palace, New York City, March 6-13. President, H. A. Cochrane, Fifth Avenue Building, New York, N. Y.

New England Section, National Electric Light Association. Question Box Convention, City Club, Boston, Mass., March 9-10. Secretary, Miss O. A. Bursiel, Boston, Mass.

With the Electrical Manufacturers

The Phillips Insulated Wire Company, Pawtucket, R. I., is distributing a 1915 calendar showing a pen and ink reproduction of its factory.

McFell Signal Company, Halsted and Twenty-ninth Streets, Chicago, has issued a booklet on its fire-alarm systems. This describes the several types of alarm boxes, gives wiring diagram, and also describes the McFell combined fire-alarm and watchman service system.

American Manufacturers' Agency, Incorporated, William H. McKinlock, president, Chicago, Ill., has taken the selling agency for the Crawford Cedar Company, of Menominee, Mich., and will be able to quote prices on a full line of Crawford cedar products.

The Esterline Company, Indianapolis, Ind., announce the appointment of Firth & Marshall, 81 New Street, New York City, as its eastern representatives for curve-drawing instruments, pyrometers and production recorders. This firm will handle the state of New York, including New York City, and the New England states.

Clapp-Eastham Company, 139 Main Street, Cambridge, Mass., has issued catalog S dealing with its radiotelegraph apparatus. The equipment illustrated and described is of the highest type and manufactured entirely in the Clapp-Eastham shops. Catalog P has also been issued by the company, this dealing with parts and materials for wireless and other experimental apparatus.

The Stuart-Howland Company, 234 Congress Street, Boston, Mass., one of the leading distributors of electrical supplies and specialties, is sending to some of its customers a 1915 calendar of more than usual interest. The calendar is adorned with a map of heroic dimensions, showing the entire war zone of central Europe, with the fortified cities wrought out for easy reference in colored ink.

Metropolitan Engineering Company, 1248 Atlantic Avenue, Brooklyn, N. Y., has issued a new series of sectional buletins to take their proper place in the company's loose-leaf binder. They refer to illustrated descriptions of direct-current cable-testing ammeters, alternating-current network protectors, and several reference sheets relating to typical service installations of the Metropoitan protective devices. Copies of these bulletins will be furnished to those interested upon request.

Munning-Loeb Company, Matawan, N. Y., has issued a bulletin, No. 600, entitled "Anodes and Plating Salts," which not only describes these products of the company, but contains information on anode characteristics, efficiencies and effect of shape, that should be of special interest to platers and all users of anodes. The bulletin is well illustrated, showing interesting views of stages of anode decomposition. The latter pages of the book contain a special discussion on single and double nickel salts. Copies of the publication will be sent anywhere upon request to the company.

The Pelton Water Wheel Company, San Francisco, Cal., has issued a very well illustrated booklet of 64 pages entitled "The Pelton System of Power." This shows the adaptability of Pelton water wheels for driving every type of machinery, and shows the surprising amount of power that can be developed from even a small stream under a moderate or high head. The booklet contains a great deal of valuable hydraulic information never before published. Copies of this booklet, which is designated as Bulletin No. 8, can be obtained from either the San Francisco or New York offices of the company on request.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has issued a catalog of its electric starting, lighting and ignition systems for

gasoline automobiles. The equipment includes lighting and battery-charging generators, starting motors, combined lighting and starting motor-generators, batteries, meters, switches, ignition apparatus, etc. Thus it is possible to provide an outfit to meet any needs, either independent or combined. All of the wiring is on the single-wire plan. The publication (No. 1532-A) describes and illustrates all parts of the equipment, giving also characteristic curves and dimension diagrams.

The Emerson Electric Manufacturing Company, 2024 Washington Avenue, St. Louis, Mo., has issued catalog No. 6700. This is the 1915 catalog of Emerson fan motors for alternating current and direct current. Each of the many types of desk, ceiling and column fans, both of the oscillating and non-oscillating types, is described in detail, with numerous illustrations. The most striking addition to the line of Emerson fans is the new nine-inch oscillator, which is designed particularly for use in homes and other places where a low-cost, light-weight and efficient fan is desired. Other new types are twelve-inch desk and oscillating fans with six blades for 25-cycle circuits; 25-cycle and 60-cycle ceiling fans have also been added.

DeLaval Steam Turbine Company, Trenton, N. J., has now ready for distribution its catalog B. This is a book of 300 pages, devoted to DeLaval high-efficiency centrifugal pumps, both of the single-stage and multi-stage types for all capacities and heads. The characteristics, design, manufacture and testing of these pump equipments is described. The adaptation and proper selection of centrifugal pumps for various purposes is explained, and several special chapters are included on speed-reducing gears and turbine-driven waterworks pumps. The book is very well illustrated, with several hundred half-tone and line illustrations, and contains much valuable information to anyone interested in pumping problems.

Record of Electrical Patents.

Issued by the United States Patent Office, January 12, 1915.

1,124,249. Manufacture of Electric Cables. G. A. Anderegg, assignor to Western Electric Co. For making twisted telephone pairs.

1,124,255. Control for Pneumatic Dispatch Apparatus. R. Ball, Philadelphia, Pa., assignor to International Pneumatic Co. Timing mechanism and control for driving motor.

1,124,260. Stop Mechanism for Winding Machines. W. E. Beadle, assignor to S. M. Langston Co., Camden, N. J. Solenoid-actuated brake applicator.

1,124,264. Starter for Engines. V. Bendix, Chicago, Ill. Relates to gear connection between starting motor and engine.

1,124,267 to 1,124,271. System for Transferring Freight and Baggage. M. U. Bernheim, assignor to Alvey-Ferguson Co., Cincinnati, O. Five patents covering details and modifications of a system, including electrically driven trucks operating in grooved ways.

1,124,272. System for Handling Freight and Baggage. M. U. Bernheim, assignor to Alvey-Ferguson Co. Modification of above.

1,124,273. System of Transferring Freight and Baggage. M. U. Bernheim, assignor to Alvey-Ferguson Co. Further details of carrier.

1,124,275. Motor Truck. P. M. Beskow, New York, N. Y., assignor to Commercial Tractor Co. Relates to motor and battery support and other details of chassis.

1,124,277. System of Distribution. J. Bijur, assignor to Safety Car Heating & Lighting Co., New York, N. Y. Axle-driven car-lighting set with special speed-controlled switch and regulator.

1,124,280. Electric-Motor-Controlling Means. J. C. Brackett, Chicago, Ill. For limiting the speed control to only one control station at a time, but permitting any station to stop the motor.

1,124,281. Process of Lining Containers. L. Bradley and H. L. Bradley, assignors to Allen-Bradley Co., Milwaukee, Wis. Metal tube for compression resistances is lined with insulating clay by spinning and baking.

1,124,290. Current-Controlling Device for Electric Circuits. G. A. Burnham, assignor to S. B. Condit, Jr., Boston, Mass. Current limiter for flat-rate lighting circuits.

1,124,303. Electric Flatiron. W. H. Dalton, Salem, Mass. Tailor's iron, with means for relieving tension from cord.

1,124,314. Automatic Telephone-Exchange System. F. R. McBerty, assignor to Western Electric Co. Selector switch with magnetic clutch.

1,124,315. Process for Electrolytically Refining Tin. G. Michaud and E. Delasson, Montreuil, France. Electrolyte composed of protochloride of tin, sulphuric acid, magnesium chloride, and boric acid.

1,124,334. Lighting Device. A. Salzer, New York, N. Y. Dome with extension drop light and colored panes about the lamp bulb.

1,124,348. Lantern. L. Gilbert Spencer, Chicago, Ill. Electric lantern of switchman's type with bail-controlled swtich.

1,124,352. Electrical Indicator for Mail-Boxes. R. Stegemann and A. Johannes, Two Rivers, Wis. Has electric alarm.

1,124,364. Process of Manufacturing Gas. B. Van Steenbergh, Goshen, N. Y. Consists in heating by electric current a contact body and catalytic material.

1,124,391. Combined Bollard and Forward-Deck Light. L. Chase, assignor to Elco Co., Bayonne, N. J. Electric boat lamp with special housing.

1,124,401. Telephone Receiver. H. C. Egerton, assignor to Western Electric Co. Has sound-tube on each side of diaphragm.

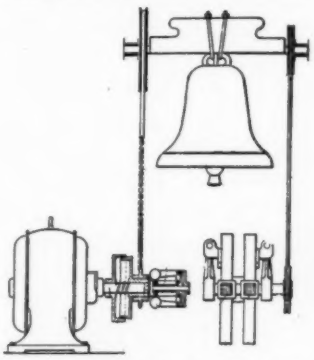
1,124,410. Fire-Alarm. F. Franek, Chugwater, Wyo. Burning of a combustible sphere allows closing of circuit.

1,124,413. Transmitter. H. Gernsback, New York, N. Y. Relates to construction of carbon-granule cell.

1,124,428. Trolley-Wheel Guard. J. C. Hanson, Moville, Iowa. Relates to control of guard arms.

1,124,456. Device for Securing Armature Coils. P. Kennedy and J. A. Misland, assignors to Consolidated Railway Electric Lighting & Equipment Co., New York, N. Y. Comprises circumferential wrapping of wire and underlying clamp bars.

1,124,460. Air Motor. G. Koesis, St. Clairsville, O., and J. Lükö, Latrobe, Pa. Compressed-air engine drives dynamo that charges storage battery.



No. 1,124,525.—Motor-Driven Bell-Ringer.

1,124,463. Indicating Device for Motor Vehicles. H. Kramer, New York, N. Y. Electrically controlled street indicator.

1,124,468. Stop Mechanism. S. M. Langston, Camden, N. J. Electrically actuated clutch-release operated upon passage of a predetermined amount of material through the machine.

1,124,470. Interrupter for Electromagnetic Reciprocating Devices. A. Le Blanc, New York, N. Y. Make-and-break device for the solenoid circuit.

1,124,473. Time-Controlled Switch. F. Leonard, Rochester, N. Y. For attachment to alarm clock.

1,124,488. Semi-Mechanical Telephone-Exchange System. F. R. McBerty, assignor to Western Electric Co. Includes point finders, keys and selectors.

1,124,505. Pneumatic-Dispatch-Tube Apparatus. J. T. Needham, assignor to Lamson Co., Newark, N. J. Pump motor is automatically started from any receiving point.

1,124,525. Mechanical Bell-Ringing Device. H. von Reppert, Cologne, Germany. Bell is intermittently oscillated by motor, which is controlled through contact disks. (See cut.)

1,124,541. Thermostat. H. D. Singer and H. V. D. Pratt, Hospital, Ill. Thermometric circuit-closer.

1,125,544. Display Lighting Apparatus. W. H. Spencer, assignor to G. F. Spencer, New York, N. Y. A cylindrical band with color elements is rotated by a motor both on its axis and at right angles thereto.

1,124,547. Mouthpiece for Transmitters. L. Steinberger, New York, N. Y. Formed of molded insulating compound so as to have narrow inner central opening to hemispherical chamber at center of diaphragm.

1,124,548. Electric Heating Attachment for Radiators. T. A. Steller, Houghton, Mich. Heating element in bottom connecting pipe.

1,124,555. Method of Exhausting Vessels. C. J. Thatcher, Upper Nyack, N. Y. For incandescent lamp with gas absorber or vacuum-getter; after mechanical exhaustion the filament is brought to intense incandescence to accelerate absorption of residual gas.

1,124,561. Coin Box. R. I. Utter, assignor to Kellogg Switchboard & Supply Co., Chicapo, Ill. Electromagnetic coin-depositing device can be operated from either main or extension telephone.

1,124,580. Method of and Means for Localizing Sound Reproduction. E. H. Amet, Redondo Beach, Cal. Includes an electrical sound transmitter operated by a talking machine, telephone receivers and an automatic device for switching in one or another of the receivers.

1,124,583. Locomotive-Stopping Apparatus. J. W. Barnes, Jr., Becket, Mass. Electromechanical means controlled by track circuits for shutting throttle and applying brakes.

1,124,598. Telegraphy. P. B. Delany, assignor to Telepost Co., New York, N. Y. Includes a local chemical recording circuit recording by currents of one polarity and means for sending currents of opposite polarity to prevent marks by local chemical action.

1,124,599. Electric-Circuit-Protecting Apparatus. G. R. Fessenden, Jr., Lancaster, N. Y. Circuit-breaker is shunted while starting the motor.

1,124,600. Method of Raising and Purifying Water. W. S. Franklin, South Bethlehem, Pa. Consists in causing ozinized air to pass through and lift the water in the pipe.

1,124,601. Apparatus for Raising and Purifying Water. W. S. Franklin. Has electric ozinizer at end of pipe.

1,124,608. Automatic Telephone System. G. Grabe, assignor to Siemens & Halske, A. G., Berlin, Germany. Includes selectors and connectors having contacts arranged in rows in a non-decimal system.

1,124,617. Electric Signaling Apparatus and Circuits Therefor. F. B. Herzog, New York, N. Y.; H. Herzog, executrix of said F. B. Herzog, deceased. Has an annunciator at the central station for each signal line.

1,124,624. Retrieving Trolley. C. E. Lang, assignor to Wasson Engineering & Supply Co., Santa Rosa, Cal. For lowering the trolley pole when trolley wheel leaves wire.

1,124,630. Dynamo-Electric Machine. H. Lippelt, New York, N. Y. Condensers are introduced into the open-coil aramature circuits shortly before the coils are disconnected.

1,124,632. Elevator Signaling System. W. B. Lucas, River Forest, Ill., assignor to Lucas Signal & Control Co. Electric floor and car signals controlled by successive changes of resistance.

1,124,635. Lighting Means for Motion-Picture Auditoriums. F. G. McPherson, assignor to Shadolite Mfg. Co., Beaver Falls, Pa. Lamps and special reflectors arranged on ceiling to light screen and front of auditorium.

1,124,653. Outlet or Junction Box. J. C. Phelps, Springfield, Mass. Base and cap have openings that can be made to close or open by relative turning of the two parts.

1,124,658. Means for Preventing the Creeping of Oil upon Shafts or Axles. C. A. Psilander, assignor to Westinghouse Electric & Mfg. Co. For railway motor with quill.

1,124,666. Electric Lock. W. A. Schutzmann, New Iberia, La. Electromagnet controls bolt.

1,124,678. Circuit-Controller. T. Varney, assignor to Westinghouse Electric & Mfg. Co. Induction-motor starter with spring to make closure of starting and running contacts.

1,124,680. Selective Signaling Device. J. A. Wotton, assignor to Western Electric Co. Pawl-actuated.

1,124,681. Lamp-Signal Apparatus for Automobiles. J. T. Wright, Metuchen, N. J. Includes special switch for controlling the circuits.

1,124,683. Percolator. T. Abtmeyer, assignor to Westinghouse Electric & Mfg. Co. The fountain tube is arranged to utilize both inner and outer heating surfaces of the heating element.

1,124,684. Pneumatic Cleaner. G. W. Allen, assignor to B. F. Sturtevant Co., Boston, Mass. Has motor-driven fan comprising one set of blades to pass air through the dust collector and a second set of blades for air-cooling the motor.

1,124,698. Apparatus for the Production of Glass Articles. B. D. Chamberlin, assignor to Empire Machine Co., Portland, Me. Motor controls the blow pipe.

1,124,700. Blow Pipe-Receiving Device for Glass-Blowing Machines. B. D. Chamberlin, assignor to Empire Machine Co. Modification of No. 1,124,698.

1,124,704. Electric Typewriting Telegraph Apparatus. G. C. Clark, assignor of four-fifths to W. H. Maxson, Oakland, Cal., and C. A. Graham, Nevada City, Cal. Sending and printing mechanisms controlled by local relays.

1,124,712. Trolley Hanger. C. H. Davis, assignor to Westinghouse Electric & Mfg. Co. Permits limited vertical movement of trolley wire.

1,124,732. Controller for Electric Motors. F. W. Harris, assignor to Westinghouse Electric & Mfg. Co. Circuit-breaker opened by failure of line voltage or reversal of any phase.

1,124,737. Sterilization of Liquids. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris, France, assignors to R. U. V. Co. Liquid is exposed to ultra-violet rays from quartz-tube mercury-vapor lamp.

1,124,751. Sender. J. A. Kropp, Newark, N. J., assignor to Western Electric Co. Special circuit-interrupter.

1,124,796. Electromagnetically Operated Device. H. G. Pape, assignor to Western Electric Co. Relates to pivot mounting of armature.

1,124,799. Signaling System. C. H. Pool, Binghamton, N. Y., assignor to Star Electric Co. Fire-alarm system.

1,124,808. Vibrator. E. J. Rohne, Minneapolis, Minn., assignor of one-half to S. N. Sorensen. Electromagnetically actuated.

1,124,809. Circuit-Controlling Apparatus. F. W. Roller, East Orange, N. J., assignor to Roller-Smith Co. Circuit-making-and-breaking device for double-reading instrument.

1,124,814. Controlling Device for Automatic Musical Instruments. J. W. Scharold, assignor to Rudolph Wurlitzer Mfg. Co., North Tonawanda, N. Y. Includes electric switch-shifting member.

1,124,819. Escutcheon Plate. C. Sikorski, Dayton, O. Has electric lamp and push-button near keyhole.

1,124,832. Time-Limit Circuit-Breaker. C. C. Badeau, Bethlehem, Pa., assignor to Roller-Smith Co. Has two movable elements, one damped and the other undamped.

1,124,849. Electrically Energized Heater. O. B. Brush, Joliet, Ill. Wire coiled about core but insulated from surrounding tube.

1,124,864. Indicating, Registering and Controlling Device Worked by an Electric Current. J. E. Colas, Paris, France. For operating electric apparatus on the locomotive through induced currents controlled by track circuits.

1,124,865. Multiple Lighting-Arrester. C. E. Cox, Eaton, O. Terminals mounted on inverted cup.

1,124,879. Automatic Film-Mover. B. Edmond and N. E. Barnes, Houston, Tex. Includes electric projecting lamp and solenoid film control.

1,124,904. Artificial Line. R. S. Hoyt, assignor to American Telephone & Telegraph Co. To simulate the impedence of an actual loaded line; comprises precomputed resistance and reactance components.

1,124,910. Electrical Heater. E. D. Johnson and G. A. Cathey, Klamath Falls, Ore. Open conical resistance element is inserted into water chamber.

1,124,913. Signaling System, Particularly for Artillery Purposes. P. Kaminski, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Two interconnected transmitters.

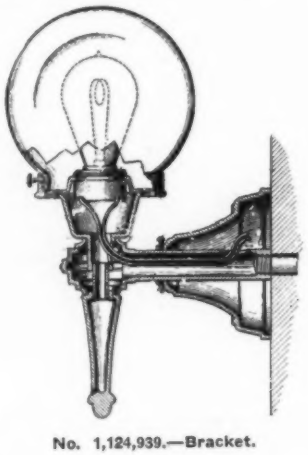
1,124,939. Electric-Lamp Fixture. T. Nelsen, Chicago, Ill. Bracket with special separable globe-holder. (See cut.)

1,124,945. Shade-Support. C. H. Petersen, assignor to J. E. Randell, Chicago, Ill. Permits the shade to expand without fracture.

1,124,969. Device for Closing Windows. J. A. Stockwell, assignor to F. E. Stockwell, Paxton, Neb. Includes electromagnetic release.

1,124,989. Insulated Rail-Joint. J. P. Wright, Newark, Del. Has flange and head-insulating plate in sections.

1,125,004. Potential Starter for Alternating-Current Motors. H. W. Cheney, assignor to Allis-Chalmers Mfg. Co. Transformers and drum-type controller are all mounted in one casing.



No. 1,124,939.—Bracket.

1,125,028. Electric Vaporizer. F. Kuhn, Detroit, Mich. Resistor is arranged within the open center of gasket in a pipe.

1,125,030. Rear Indicator for Vehicles. G. A. Laubersheimer, Los Angeles, Cal. Electric lamp and semaphore.

Patents Expired.

The following United States electrical patents expired on December 28, 1914:

596,054. Electric Railway. E. C. Crocker, Bridgeport, Conn.

596,085. Electrical Signal Bell for Street Cars. J. P. Orr, Pittsburgh, and T. F. Galvin, McKeesport, Pa.

596,131. Trolley. A. Travaglini, Philadelphia, Pa.

596,134. Signaling Circuit for Fire and Police Systems. A. Earrett, Kansas City, Mo.

596,135. Securing Means for Covers of Dynamo-Electric Machines. N. C. Bassett, Lynn, Mass.

596,136. Armature Winding and Coil. A. F. Batchelder, Schenectady, N. Y.

596,152. Detachable Laminated Pole-piece for Dynamo-electric Machines. H. Greisenhöner, Schenectady, N. Y.

596,157. Apparatus for Electrolytically Producing Alkalies. J. Hargreaves, Widnes, England.

596,160. Electric Heater. Hugo Helberger, Munich, Germany.

596,172. Lead for Sounding. J. Mohs, Brandenburg, Germany.

596,182. Electric Railway. W. R. Potter, Schenectady, N. Y.

596,186. Phase Regulator. C. P. Steinmetz, Lynn, and E. W. Rice, Jr., Swampscott, Mass.

596,190. Induction Wattmeter. E. Thomson, Swampscott, and W. H. Pratt, Lynn, Mass.

596,197. Electrical Protective Device. A. S. Williams, Newton, Mass.

596,201. Electrical Signaling System. J. P. Buchanan, Boston, Mass.

596,224. Trolley Rail. W. A. P. Willard, Jr., Hull, Mass.

596,225. Trolley Rail for Electric Roads. W. A. P. Willard, Jr.

596,226. Electric Signaling System. A. J. Wilson, Port Chester, N. Y.

596,229. Underground Junction Box for Electric Conductors. W. F. Bossert, Utica, N. Y.

596,236. Electric Gas-Lighting Device. A. L. Bogart, New York, N. Y., and L. R. S. White, Waterbury, Conn.

596,250. Fire Telegraph Repeater. F. A. Skelton, Newton, Mass.

596,272 to 596,274. Electric Bicycle. H. W. Libbey, Boston, Mass.

596,276. Telephoning from Cars in Motion. H. W. Libbey.

596,283. Electric Current Meter. R. P. Wilson, London, England.

596,306. Dynamo-Electric Machine. P. W. Power, Pittsfield, Mass.

596,320. Printing Telegraph. B. A. Brooks, Brooklyn, N. Y.

596,356. Electric Call-box System. W. T. Budds, Charleston, S. C.

596,363. Quick-break Switch. R. C. Demary, Buffalo, N. Y.

596,418. Magneto-electric Signaling Apparatus. A. S. Williams, Newton, Mass.

596,456. Trolley for Electric Railway Cars. E. Cone, Chicago, Ill.

Reissue 11,645. Signaling Circuit. J. J. O'Connell, Chicago, Ill.

The following electrical patents expired January 4, 1915:

596,483. Electric Fan. O. F. Conklin, Springfield, O.

596,496. Telephone. W. Gray, Hartford, Conn.

596,506. Electric Switch. W. S. Hill, Hyde Park, Mass.

596,509. Signaling Apparatus for Telephone Systems. F. J. Holmes, Cleveland, O.

596,512. Automatic Stop-motion Snap Switch. J. D. Ihlder, Yonkers, N. Y.

596,513. Compound Brake for Electric Elevators. J. D. Ihlder.

596,514. Safety Magnet Brake. J. D. Ihlder.

596,515. Starting Box for Electric Motors. J. D. Ihlder.

596,567. Converter for Monophase Currents. A. Blondel and G. Sautter, Paris, France.

596,582. Means for Varying Candlepower of Incandescent Electric Lamps. C. E. Felch. Natick, Mass.

596,609. Supervisor Signal for Telephone Switchboards. F. R. McBerty, Downers Grove, Ill.

596,610. Signaling System for Telephone Trunk Lines. F. R. McBerty.

596,625. Plug and Springjack for Telephone Switchboards. C. E. Scribner, Chicago, Ill.

596,626. Springjack for Telephone Switchboard. C. E. Scribner.

596,627. Annunciator for Telephone Lines. C. E. Scribner.

596,628. Supervisory Signal for Telephone Switchboards. C. E. Scribner.

596,629. Testing Apparatus for Multiple Switchboards. C. E. Scribner.

596,630. Apparatus for Telephone Switchboards. C. E. Scribner.

596,654. Process of Producing High Vacuums. E. F. Dwyer, Lynn, Mass.

596,680. Alarm-clock Attachment. P. C. Howe, Boston, Mass.

596,696. Electric Oven. L. E. Custer, Dayton, O.

596,719 and 596,720. Magnetic Ore Separator. L. G. Rowland, Camden, N. J.

596,729. Support for Electric Lamps. O. C. White, Worcester, Mass.

596,774. Electric Signaling Apparatus. F. B. Herzog, New York, N. Y.

596,791. Voltaic Battery. H. E. de R. de Lavison, Neuilly-sur-Seine, France.

596,806. Apparatus for Telephones. F. B. Cook, Chicago Ill.

596,808. Telephone Transmitter. D. A. Fleming, Indiana, Pa.

596,812. Subterranean Electric Conduit. W. D. M. Howard, Redwood City, Cal.

596,834. Telephone Transmitter. J. H. Spencer and M. S. Keyes, New York, N. Y.

596,850. Telephone Switch Plug. F. B. Cook, Chicago, Ill.

596,851. Telephone Apparatus. F. B. Cook.

596,852. Switch for Telephone Circuits. F. B. Cook.

596,907. Electric Cable for Propulsion of Vehicles. A. Norman, Toronto, Canada.

596,923. Automatic Potential Regulator for Dynamos. A. A. Tirrill, Whitefield and P. S. Tirrill, Groveton, N. H.

596,926. Trolley Guard. H. J. Vogler and A. Flores, San Antonio, Texas.

596,943. Electric Clock. F. Richard, Lynn, Mass.

596,955. Automatic Temperature Regulator. A. A. Boss, Detroit, Mich.